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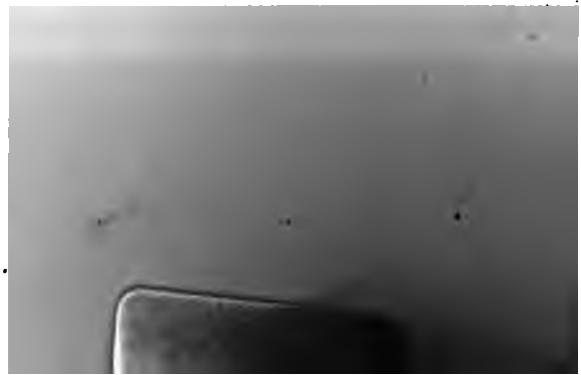
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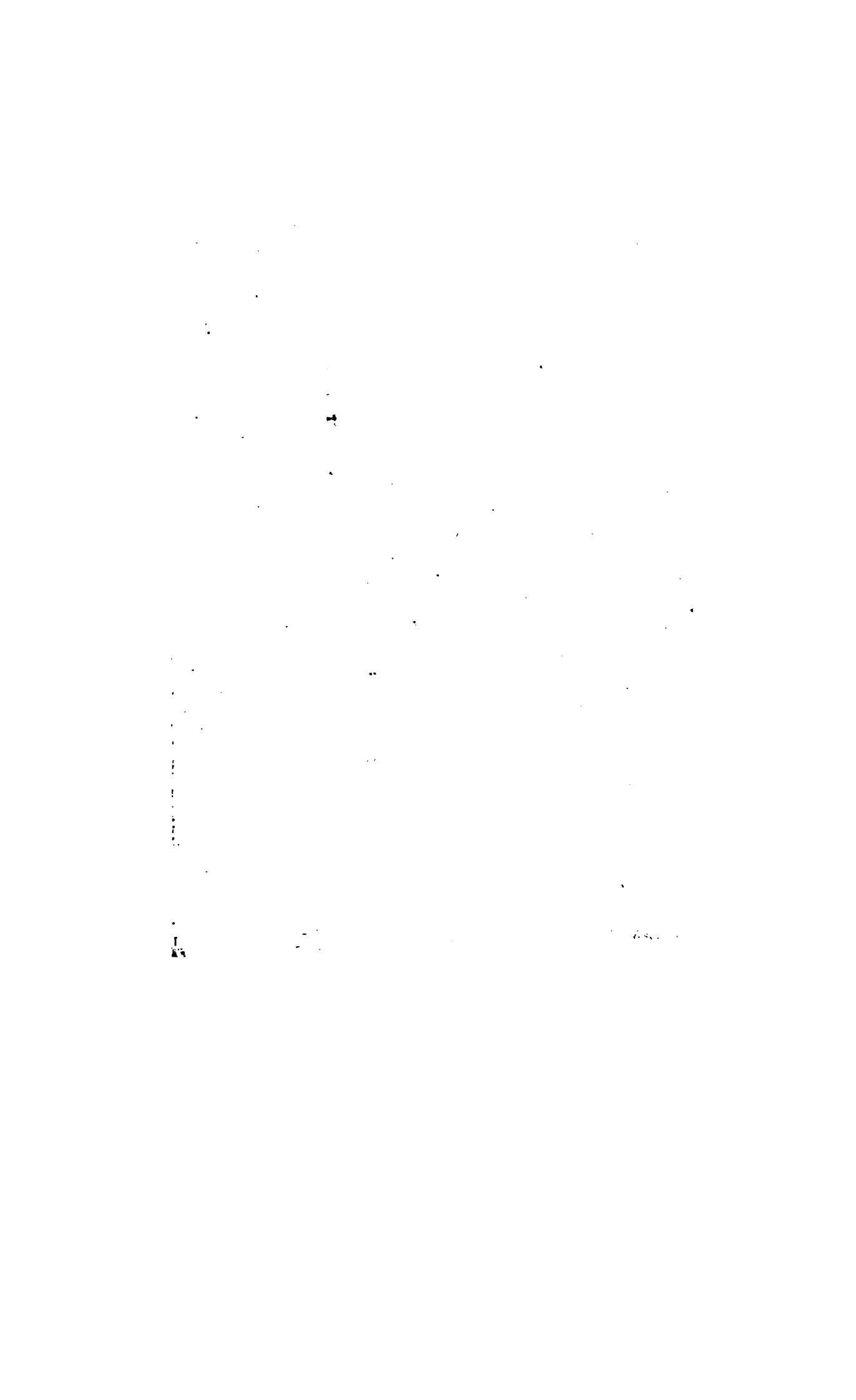
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9.

PRIZE ESSAYS
AND
TRANSACTIONS
OF THE
HIGHLAND SOCIETY
OF
SCOTLAND.

TO WHICH IS PREFIXED,
AN ACCOUNT OF THE PRINCIPAL PROCEEDINGS OF THE
SOCIETY DURING THE YEARS FROM APRIL 1807
TO JANUARY 1815, BOTH INCLUSIVE,

DRAWN UP AT DESIRE OF THE SOCIETY,

BY

HENRY MACKENZIE, Esq.
ONE OF THE DIRECTORS.

VOL. IV.

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The *Introduction* having been prepared with a view to the publication of this volume early in 1815, but which has been delayed from particular causes, contrary to the wishes of the Society and of the Publishers, it becomes necessary to notice the variations between this part and the body of the volume, which this delay has occasioned. The Appendix, No. I., contains a List of the Members as they stood in January 1816, instead of January 1815, as referred to in the *Introduction*;

and No. II. a List of Office-Bearers and Directors for the year 1816. To the Memorial on the Distilleries (Appendix No. III.) alluded to in the Introduction, there is now subjoined a Report of the Committee of the Society, on the same interesting subject, of so late a date as February 1816. But the departure from the original plan of the Volume, which there is the greatest reason to regret, is the want of The Essay on Woods and Plantations, mentioned in the Introduction, page xlviij. The gentleman first employed as Editor, and with whom all the papers were lodged, having removed to the country soon after receiving that Essay, it was by some accident mislaid, and could not be found when wanted for the press; and, unfortunately, the writer had preserved no copy of it. With the hope of finding it in time for making a part of this Volume, the publication of the book has been considerably delayed: But some recent Communications of merit, which have found a place in this volume, may in some measure compensate for its publication having been postponed to the present time.

26. *February 1816.*

INTRODUCTION.

ACCOUNT OF THE PRINCIPAL PROCEEDINGS OF THE HIGHLAND
SOCIETY OF SCOTLAND, DURING THE YEARS FROM APRIL 1807,
TO JANUARY 1815, BOTH INCLUSIVE.

IN the former volumes of the history of the HIGHLAND SOCIETY, the nature of its Institution, and the objects to which its labours and assistance have been directed, were sufficiently developed. These were in general every thing that offered itself to their consideration as tending to the improvement, whether in industry, in cultivation, or in discovery, of this country, in all its districts,—the Society's excitement and encouragements having long embraced every part of the Lowlands, as well as the Highlands of Scotland. It has continued to prosecute the same objects, with equal zeal and attention, and with an

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a

effect

somewhat more extensive, in proportion to the increased number of its members, and the increased amount of its revenue. Of its Members, the number, as well as the respectability, are as great as its most sanguine friends could have hoped for ; * its revenue has, under the excellent management of its late worthy treasurer, been considerably augmented. It is still, however, short of that amount which would enable its directors to give all the encouragement to various branches of national industry and improvement which they could wish ; but they hope to receive such assistance from Government, as may equalize more nearly the power of the Society, with its inclination to lend its aid to the useful and patriotic exertions of every individual, as well as public body, interested in the progressive improvement of Agriculture, Manufactures, and Commerce, in this part of the kingdom. The following short account of its proceedings, will enable the public to appreciate the value of its inquiries and exertions. They will be given with only as much 'detail' as seems to be necessary to a right understanding of the objects to which they were directed, and will be classed, as in the former volumes of the account of its transactions, rather according to the nature of the subjects, than to the chronological order in which they occurred.

AGRICULTURE.

* *Vide* a List of them as they stood in January 1815, in the Appendix, No. I.

AGRICULTURE.

Improvement of Waste Lands.

The improvement of those districts of Scotland, to which the system of excellent husbandry, practised in other parts of the country, has not yet reached, has been always a favourite object of the Society. Premiums, for bringing into culture those extensive tracts of waste land, which lie neglected in many distant parts of the country, had been formerly given to *Inverness-shire*, and to the upper divisions of *Elgin* and *Nairn-shires*. Those premiums were transferred in rotation to certain parts of *Aberdeen*, *Banff*, and *Ross-shires*, and to another, which, though remote from the northern counties in geographical position, stood equally in need of excitement to agricultural industry, the Island of *Arran*. In all those districts, the Society has had the satisfaction to find, that their endeavours to excite the spirit of improvement, have been extensively successful. Besides the regular premiums for the general encouragement of industry among the bulk of the people, the Society were happy to have an opportunity of distinguishing certain individual farmers,
whose

whose exertions had been eminently meritorious and successful, in reclaiming from an unproductive state considerable portions of land, in Highland situations, where hitherto agriculture had made but little progress. Honorary premiums were adjudged to Mr *John M'Neill*, in Patnellan, parish of Callendar, and Mr *Hugh M'Donald*, in South Ardchonel, in the district of Lorn in Argyllshire. Mr M'Neill's exertions appeared to have been particularly meritorious, having brought into culture from heath, a tract of thirty acres, within the space of five years. A medal was also bestowed on *James Taylor*, overseer or grieve to General Campbell of Lochnell, for having reclaimed, by an ingenious mode of draining, twelve acres of moss.

Green Crops.

The Society have been particularly anxious to promote the turnip husbandry, and the culture of various kinds of grasses, in that part of the Highlands where this material improvement had not been practised. For this purpose they voted premiums for the largest proportion of farms, in the possession of actual farmers, under Green Crops, in the counties of *Argyll* and *Bute*, in *Ross* and *Inverness-shires*, and the *Isle of Sky*, and afterwards in some of the less cultivated parts of the county of *Wigton*, and the stewartry of *Kirkcudbright*.



INTRODUCTION.

Among the Grasses of modern introduction, the *Fiorin* has produced more discussion than any other which has been tried for a long time. The opinions of its usefulness have been various, and have generally floated between opposite extremes, as the zeal of its partizans, and the objections of its opponents, have divided the agricultural world. Its chief acknowledged merit seems to be, its standing the utmost severity of winter, which must render it a most valuable grass in the Highlands, where provender is at that season extremely scanty and difficult of access, and where the moist soil which is peculiarly favourable to the growth of this plant, is generally prevalent in the lower grounds,

Black Cattle.

Premiums have been given for specimens of the best breeds of Black-Cattle, by rotation, in most parts of the country where such premiums were considered necessary or useful. They are generally offered for two or three successive years in the same districts; and in several parts of the Highlands, they have had these in rotation two or three times. The competition for the cattle premiums in 1814, embraces seven districts, viz. three in Inverness-shire, one in Ross-shire, one in Wigtonshire, and one in the remoter districts of each of the counties of Edinburgh and Ayr. They are given for the best Bulls, and for Queys

Queys or Heifers bred by the competitors. It will be observed, that these premiums, formerly confined to the Highlands, are now extended to such districts in the south country, as in the opinion of the resident members of the Society may be benefited by them.

Ploughing.

Good ploughing is one of the elementary processes of agriculture, to which the Scots farmer in those districts where improvements were earliest introduced, and most widely diffused, was particularly attentive. Sensible of its importance, the Highland Society, at a very early period, gave premiums to a considerable amount for its encouragement. But the Society must, from its nature, and the extent of its means, limit its exertions chiefly to excitement, rather than to remuneration, which will always be best found in the usefulness of the arts and species of industry, which agriculturists may introduce or improve. Such was the case with the art of ploughing. The premiums given by the Society for ploughing, diffuse, through most of the Scots districts, a spirit of emulation among the farmers and their servants, to excel in that article of labour; and various local societies have been formed, which give considerable sums in premiums to the best ploughmen within the limits to which their encouragement is directed. Competitions of this sort are now almost universal,

so that there are comparatively but few places to which it is necessary for the Society to continue its premiums for ploughing. But to such as, from their peculiar situation, stand in need of its assistance, it still continues to extend these premiums, which the co-operation and attention of the country gentlemen who are appointed judges of the competitions, have materially assisted in producing the improvement they were intended to promote. This attention, and the spirit of emulation which it has roused, have had effects much more extensive than the single objects which it originally had in view would have produced. From experience of the usefulness of those meetings and combinations in favour of ploughing, several agricultural societies have taken rise, of material advantage to, and improvement of those quarters of the country within which they are established. By means of such societies, information is diffused, experiments are tried, and the value of such experiments brought to a test, much more fair and conclusive than when they are practised by single and isolated individuals, often too rapid and too sanguine for cool investigation, or for accurately calculating the value of new or recently adopted modes of cultivation.

Plantations.

Among the subjects of agricultural improvement on which the Society bestowed its attention, may be mentioned,

mentioned, the honorary premiums which it offered in 1811, to proprietors of estates on the north and west coasts of Scotland, “ who should plant the greatest extent of ground after being properly inclosed ; half of the plants to be larix or hard wood.” This last condition was annexed from the consideration of that predilection which long established custom had introduced in favour of *Scots firs* exclusively, though it seems certain that many other species of trees are preferable, not less on account of their certainty of growth, than of their value when grown.

These premiums excited the attention which the Society hoped, in districts where such encouragement was most necessary ; such were awarded to Mr Maclean of Ardgower, Mr Maclean of Coll, Mr Innes of Lochalsh, Mr Macdonald of Staffa, and Mr Mackenzie of Applecross, each of whom had made plantations on an extensive scale on their respective estates, within the period to which the premiums applied, as ascertained by inspection, and reports made to the Society by those of its members who were entrusted with that duty.

Besides those particular and specified objects for which encouragements were held out by the Society, premiums were given for the best managed farms in general, in some of the remoter and less improved counties of Scotland, and for ascertaining the comparative advantages of different modes of soiling cattle, &c. Statements of the results of those premiums will be found in the present volume.

Among

Among the subjects connected with agriculture, and of material importance to the farmer, may be mentioned the establishment of a *Dairy* at Willow-bank, in the vicinity of Glasgow, by Mr William Harley, a member of this Society, possessing many advantages over dairies hitherto constructed, particularly with regard to the health of the cattle, and the quality of the milk. As a testimony of their opinion of the usefulness of this establishment, especially in the neighbourhood of large or populous towns, the Society has recently voted a piece of plate, of twenty guineas value, to Mr Harley, after an accurate examination and report, by a committee of members of the Society residing in Glasgow.

Invention and Improvement of Machinery connected with Agriculture.

Under the general head of *agriculture*, may be noticed the attention and encouragement which the Society has bestowed on machinery connected with that art. Besides the just and honourable tribute which the Society paid to the memory of the late Mr Small, (inventor of the well known plough which bears his name) by a liberal subscription in favour of his sons, to assist them in prosecuting that business in which their father was so eminent and useful, it voted a premium of twenty guineas on the report of the Earl of Cathcart, and a committee of its

its members, to *Mr James Veitch* of Inchbonny, near Jedburgh, for an improvement made by him on the plough, as originally constructed by Mr Small, and for a *dynamometer* invented by him for ascertaining the degree of force required in different kinds of ploughs. The report of that committee, with illustrative drawings, will be found in this volume, as well likewise an account by Mr Shirreff, and relative drawing made by Mr Gray, millwright, whom the Society employed to examine a machine newly introduced in some parts of Scotland, particularly in East Lothian, called a Grubber or Scarifier, employed for the purpose of pulverizing the ground, and which, in the case of light soils, may supersede the necessity of a second ploughing.

The *thrashing-machine* is certainly one of the most useful implements which has been introduced into modern agriculture. The country owes its invention to *Mr Meikle*, millwright of East Lothian, for the benefit of whose family the gratitude of some of the farmers of that and other counties, opened a subscription in 1810, to which the Highland Society contributed the sum of thirty guineas. It likewise voted a medal to *Mr Monteith* at Harperston, in the county of Perth, for a *thrashing-mill* constructed by him on a principle somewhat different from that of Mr Meikle, which was reported, by a committee who had examined it, to be particularly well calculated for any situation where water could be obtained as the power to be employed. A premium of

ten

ten guineas was also voted to *Mr Walter Samuel*, an ingenious mechanic of Linlithgowshire, for his discovery of a new method of yoking horses in thrashing-mills, whereby less strength is required to work them.

Reaping-Machines.

Amidst the universal propensity to abridge labour, by resorting to machinery in agricultural speculations, the invention of a machine for *reaping* has been one of the chief objects of rural mechanics, but has been found to be attended with more difficulty than any other implement within the range of agricultural invention. From a consideration of this difficulty, as well as of the usefulness of such a machine, if accomplished, the *Dalkeith Farmers' Society* offered a premium of no less a sum than L. 500 for a reaping-machine, which should be found to answer the purpose wished for. The *Highland Society*, to which this object had early occurred, had previously offered a premium for such an invention, and in consequence, a variety of models had been laid before them, constructed on principles of various degrees of ingenuity, to which various degrees of encouragement had been given; but that which at last was universally allowed to bid fairest for success, was a reaping-machine, invented by *Mr Smith* of Deanston

ston cotton works in Perthshire, which, after being examined by several members of the Society, most conversant in the principles of mechanics, was tried in actual reaping on a field near Dalkeith, before a joint committee of the Highland and Dalkeith Farming Societies, in which it operated with very considerable success ; and though some objections to its perfect operation induced the Dalkeith Society not yet to adjudge their large premium to its inventor, yet it showed such an approximation to the purpose required, as to give hopes that future improvements may bring it up to the point at which its powers and execution may answer the wishes of those societies. It is a singular coincidence, and favourable to Mr Smith's invention, that *Mr Kerr*, mathematical instrument maker in Edinburgh, without any previous knowledge of, or communication with Mr Smith, had, about the same time, constructed a reaping-machine upon the same principle, a model of which may be seen at the Highland Society's Chambers.

Among the minor articles of machinery laid before the Society during the period to which the present volume of its transactions applies, is a machine for raising stones, constructed by Mr *Harrieman*, manager of the *Lorne Furnace Company* ; and another intended to be attached to thrashing-mills, for *humbling* (as the Scottish phrase is, or taking off the heads) of *barley*, and *bear* or *bigg*, invented by *Mr George Mitchell*, mill-wright at Bishops' Mill, near Elgin, and a third the invention of

of *Mr Lovi*, thermometer-maker at Edinburgh, of a thermometer for ascertaining the heat of compost dunghills. A premium was also voted, in 1813, to *Mr Walter Samuel*, for an improved method of coupling and yoking *harrows*.

Machinery connected with the introduction of the Woollen Manufactory in the Highlands.

The Society, soon after its institution, as mentioned in its history prefixed to the first volume, had directed its attention to the improvement of *wool*, and the introduction of branches of the *woollen manufactory* into the Highlands. This gave birth to a society, founded by Sir John Sinclair, under the name of the *British Woollen Society*, to which, of course, the Highland Society relinquished that branch. The Woollen Society has been dissolved or discontinued for some considerable time, which has induced the Highland Society, in some measure, to resume this object, which is also encouraged by the Board of Trustees for Manufactures.

The Society have, since the publication of the last volume, voted,

To <i>Mr Daniel Clark</i> , Campbelton,	L.	50	0	0		
To <i>William Ferguson</i> , Arrochar,	-	21	0	0		
To <i>Mr Beath</i> , Lochgilpead,	-	-	21	0	0	
To <i>Mackay and Kennedy</i> , Machine-Makers, Glasgow	-	-	-	21	0	0
				To		

To *Mr Maclauchlan*, at Auchleven, Argyllshire, - - - - L. 21 0 0

all for constructing machinery, and introducing the same into different parts of the Highlands, for teasing, carding, and spinning of wool, and in some of these instances making the same into cloth. A premium of ten guineas has also been voted to *Mr Mercer* at Wilderhaugh, near Gallashiels, for a machine constructed by him, connected with the improvement of the woollen manufactory.

Among articles which may be considered of a mixed nature, partly of growth and partly of manufactures, one of great importance to the Highlands and Islands, is

Kelp,

which is made of the sea-weeds, produced in more or less abundance, on most of the shores of those districts. It was stated, at a general meeting of the Society, held on the 4th of July 1814, that kelp had recently fallen so much in price, as to afford no adequate inducement for manufacturing it; and that, except some means were used for preventing its decline, this branch of manufacture, so important to many districts of Scotland, was in danger of being altogether lost to this country.

The Society were sufficiently aware of the true principles of political economy, to make them cautious

tious of interfering, as had been sometimes proposed, with the importation of the foreign article, which is the rival of kelp, the *barilla*; but they conceived it to be an object equally legitimate and useful, to endeavour to raise the value of the native kelp, so as to make this country more independent of that foreign importation than it had hitherto been, and therefore appointed a committee, to which they anxiously recommended the consideration of this subject, and the speedy adoption of such means as should appear most likely to increase the quantity of the most productive species of sea-weed or sea-ware, as well as to meliorate its quality, by having it manufactured in the best manner. That committee circulated a set of queries, calculated to procure information on these subjects, and afterwards made an interim report, which was laid before the Society, containing suggestions for particular and minute inquiry, and detailed experiments on various points, tending to elucidate them. The committee has taken measures for further and more complete inquiries on this interesting subject, and for ascertaining the justness of opinion and conjecture, by actual and repeated experiments. After receiving such information, and ascertaining, by such experiments, the best means of procuring kelp of good quality, the committee proposes to lay before the Society a general report, containing a full statement of the subject, in the various points of view in which it seems material to consider it.

GENERAL PUBLIC MEASURES.

Fisheries.

The fisheries constitute so essential a part of the resources and productive industry of the Highlands, and are indeed so important to the prosperity and safety of the empire, particularly in the nursery which they afford of seamen of the hardiest kind, that they became at an early period one of the principal objects of the attention and encouragement of the Society, who communicated to government such information, as their numerous members, as well as correspondence, enabled them to obtain on that subject. Of this nature particularly, were the Society's observations on an amended bill, transmitted for their consideration by the Right Hon. George Rose, for regulating the fisheries, which afterwards was brought into parliament, and passed into a law. That distinguished Member of Parliament had bent his mind long and earnestly to this national object, and could properly appreciate the suggestions of the Society, both with regard to the kind of boats * or vessels

* See an Essay or communication of an intelligent practical fisher, Mr John Mackenzie, of Richmond Place, Edinburgh, on the size of boats

sels best adapted for that service, and to such regulations as might be most conducive to the success and credit of the fishery, and the good quality of the fish produced by it. The Society, at a general meeting in June 1808, voted the thanks of the Society to Mr Rose, who is an honorary member of it, "for the uncommon trouble he had taken in collecting and arranging information, and bringing forward this measure, which, while it promised to be of great national importance, was of peculiar interest to Scotland, the coasts of which form the principal seat of the herring-fishery." The regulations of this Act of Parliament have now been in operation several years, and have certainly been extremely useful to the fishery, particularly the leading measure for which it provided, namely, that of constituting a Board for its direction and superintendence.

Roads and Bridges.

The importance of opening a communication, by Roads and Bridges, to the distant parts of the Highlands, had been felt at a very early period, and government had voted such an annual sum for making these roads, and building these bridges, as seemed necessary to secure that communication.

Of this public aid and encouragement, and of the
VOL. IV. *b* information

best adapted to the successful fishings, on the north western coast of Scotland.

information and suggestions communicated to government by the Highland Society on the subject, an account has been given in the two last volumes of the History of the Society's transactions. Within the period to which the present volume relates, a considerable change seemed to have taken place in the ideas of government on this matter. They conceived that now, the situation of the different districts through which these roads passed, or through which new and improved lines of road were to be opened, was such, as that they could afford to open up such new communications, and to keep the old ones in repair at their own expence, independently of the sum which Parliament had for a long time been in use to grant for those purposes. A bill was brought into Parliament in December 1813, of which the principal objects seemed to be to place the Highland roads, as well the ancient military ones as those recently made by the direction of the parliamentary commissioners, under the management of a board of commissioners specially constituted for that purpose ; but to withdraw the aid hitherto voted annually by Parliament for the object in question, the necessary sums, with the exception of the expence of building bridges above a certain span, being to be raised by an assessment on the counties through which the roads pass. It appeared to this Society, who possessed means of accurate information on the subject, that this mode of levying the money would be both inadequate to its object, and inequitable in the burthen which it imposed ;

posed ; inadequate from the inability of those remote and barren districts to afford the sum required ; and unequal, as that burthen would fall on certain counties and districts through which the roads happened to pass, without any part of it being borne by other districts of the country, which derived equal or greater benefit from the communications thus opened to the public. Indeed, it may be considered as a general principle, that, in all such improvements and facilities of communication, the public at large are at least as much benefited as any portions of the country, which at first sight may appear to be more immediately interested in them. It were easy to extend the parable of *Menenius*, to shew, that the heart cannot say to the little finger or toe, “ You are so remote, “ that I am independent of thee, whether for good “ or ill ;” the truth being too plain to be disputed in these enlightened days, that the improvement of the most distant corner of the most distant province, is a benefit to the whole empire. To place this truth, however, in a strong light, and to shew how applicable it was to the subject in question, a committee of the society, to which this matter had been referred, drew up a report, copies of which were transmitted to the Chancellor of the Exchequer, the Speaker of the House of Commons, and the other parliamentary commissioners for roads and bridges, which appeared to have had considerable influence on the measures recommended by those commissioners to Parliament, as the proceedings of the Society, and the report of
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the committee were quoted at length, and with much approbation, in the report of those commissioners laid before the House of Commons, in the session of parliament 1813-14, in consequence of which a bill was brought in, in which most of the suggestions offered by the Society, and approved of by the commissioners, were adopted. The measure of constituting a special board of commissioners for the direction and management of those roads, had met with their entire approbation, which was accordingly sanctioned by that bill ; and the extent of the contribution from the counties in aid of the fund allotted from the public purse, was rendered moderate and equitable. Under these regulations, and the superintendence of the board above mentioned, there seems to be the fairest prospect of accomplishing this important national object, in the manner most conducive, both to the particular interests of the districts traversed by these roads, and to the general prosperity of the empire.

The Distilleries.

* As a manufacture closely connected with the agriculture, as well as with the revenue of the country, the distilling of home made spirits has been always an object of much attention to the legislature ; and the Highland Society has been repeatedly called on to consider it, as an object of the first importance to the general interests, political and moral, of the community,



munity, and particularly of the Highlands, where, from peculiar local circumstances, the consumption and use of spirits is more necessary than to other parts of the country, where other articles not transportable through many of the northern districts, such as beer and ale, may supply their place. A committee consisting of gentlemen deputed by different Highland counties, was appointed, in 1806, to consider this subject, who afterwards applied to the Highland Society for its assistance and support in such measures as should be deemed expedient for encouraging the legal, in opposition to the illicit distilling. A committee appointed by the Society to co-operate with that from the counties, having collected every information which they judged essential to the purpose, prepared a memorial, which having been approved of by the Society, was afterwards transmitted to the Lords of the Treasury, by whom it was referred to the Commissioners of Excise in Scotland. The leading suggestions in that memorial (which will be found in the Appendix, No. 3,) were to lay on such a proportional duty, and to levy that duty in such a manner, as to enable the licensed distiller in the Highlands, to enter into a fair competition, on equal terms, with the Lowland distiller, which the committee conceived to be the only effectual means of checking illicit distillation, not only from its producing the article free from the risk, and consequently increased price of smuggled spirits, but also because the licensed were the best informers against the illi-

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cit traders, whom, however hurtful might be their practices to the revenue and the country, it was unpopular and not altogether safe for individuals to inform against. They also proposed a reconsideration of the boundary between the Highland and Lowland districts, so as to include within those respective limits all places which stand in the same, or nearly the same local circumstances.

This memorial, as the Society understood, was approved of, as to the above-mentioned suggestions, by the Commissioners of Excise, but they objected to another suggestion which the Society had made, namely of a license to the Highland distillers to export to the Lowlands a certain proportion of their spirits, on payment of a certain equalizing duty, which the Commissioners considered inexpedient, as opening a door to fraud and evasion.

After a considerable period of dormancy in this measure, an act was passed last session of Parliament, containing several of the provisions recommended by the Society, which it is hoped may remedy the evils complained of ; but as some of those provisions have been stated by many Highland proprietors to be founded on calculations not corresponding to the circumstances of the Highlands, the Society has continued its committee on the distillery, with the sole view of contributing the most impartial and satisfactory information in their power, towards the accomplishment of an equalization of the duties in different parts

parts of the country, equally advantageous to the consumer and to the revenue.

EQUALIZATION OF WEIGHTS AND MEASURES.

The advantage of having but one system of weights and measures in any country, is too obvious, and too generally acknowledged, to require any illustration. Where a variety of measures prevail, the time that is lost in reducing one of them to the other, the errors that are committed, and the frauds that are concealed, probably amount to a quantity much greater than is generally imagined. The evil indeed has always been sufficiently felt, and the remedy has been earnestly wished for; but has appeared to be surrounded with difficulties which, we are persuaded, when closely examined, will be found much less formidable than when viewed at a distance.

In Scotland those inconveniences have frequently drawn the attention of such individuals and societies as took an interest in the public prosperity, and had been urged with great force at the meetings of the Highland Society of Scotland, particularly at the general meetings in January and July 1811.

A committee of the Society was, in consequence, appointed, who, in a matter of such general interest to the community, wished to have the information and

and assistance of the gentlemen of the country at large; and accordingly procured a meeting with a considerable number of the most intelligent landed proprietors of most of the counties of Scotland, to whom those counties had entrusted this business, together with several members of the *Convention of Royal Burghs*, who, at a meeting held in November 1811, agreed to appoint a committee for the purpose of investigating this subject, and taking such measures as should appear most expedient and effectual for attaining the end in view; namely, that of an equalization of the weights and measures of Scotland at least; and if it should be found practicable, or agreeable to the sentiments of the sister country, to extend the regulations also to England, without which indeed, from the constant interchange of commodities between the two countries, the measure would lose more than half its efficacy.

In December 1812, this committee, after procuring every information in their power, and repeated discussions of the subject, brought forward a very full and elaborate report, containing an historical account of the different legal standards from time to time established in Scotland, England, and, as far as could be ascertained, in Ireland, with a proposal or suggestion for a ratification and uniformity of those standards. In framing this proposal, they had the advantage of a sketch of the subject, which they were fortunate enough to procure from Mr Professor Playfair

Playfair of Edinburgh, drawn up with that clearness and ability for which all that gentleman's compositions are so distinguished.

This report having been considered, first at a full meeting of the Society's committee, attended by the gentlemen from the counties and the convention of burghs, and also at a general meeting of the Society held on the 12th January 1813, was then directed to be transmitted to the Conveners of the counties, chief Magistrates of Royal Burghs, and other public bodies, and commercial institutions in Scotland, and the report was also communicated to many noblemen and gentlemen of both houses of Parliament.

The suggestions and report meeting with the general approbation of the counties and principal commercial institutions of Scotland, and being also approved by such of the royal burghs as had considered the subject, and there being reason to hope that the plan might meet with such support as might lead to an equalization of weights and measures over the kingdom at large, a notice was given in the House of Commons, at the request of the Society, by the Right Honourable George Rose, that the subject of an equalization of weights and measures would be brought under the consideration of Parliament in the then ensuing session. Meantime it was suggested to the committee, that, in order to expedite matters, and to bring the details proposed more pointedly

edly in view, it would be proper for the committee to draw up the heads of a bill, for the consideration of every person conversant or concerned in the subject.

In consequence of this suggestion, the committee, of which Mr *John Tait* was the zealous and indefatigable convener, prepared the heads of a bill, which was communicated to the counties, burghs, and principal commercial bodies in Scotland;—also to Lord Melville, the Chancellor of Exchequer, Mr Rose, Sir George Clerk, and several other members of Parliament who took an interest in the object in view, and were disposed to promote its success. These heads of a bill were generally approved of, and some additions and amendments were made upon them, in consequence of such suggestions as were received from the Chamber of Commerce of Glasgow, and other quarters.

Matters being thus prepared, Sir George Clerk, member for the county of Edinburgh, introduced the subject in the House of Commons, by moving for a committee to inquire into the original standards of weights and measures in this kingdom, and to consider the laws relating thereto, with their opinion of the most effectual means of ascertaining and enforcing uniform and certain standards of weights and measures to be used for the future. A select committee was accordingly named for this purpose, consisting of twenty-five members most conversant with the subject,

subject, among whom were gentlemen from all parts of the united kingdom, Sir George Clerk being chairman of the committee.

This committee, after examining Professor Playfair of Edinburgh, Doctor Wollaston, Secretary of the Royal Society, and others, made a report to the House, and their report was ordered to be printed.

From the train in which this important matter now is, there is every reasonable ground to hope that the intention of the Highland Society, and the wishes of the country, may be soon carried into effect, so as to establish a general uniformity of weights and measures in both parts of the united kingdom.

In order to understand the scheme proposed in the report of the committee, it must be remarked, that, to obtain a standard perfectly uniform, capable of being accurately communicated, and easily replaced if it happen to be lost, it would be assumed so as either to be one of those quantities which nature preserves always of the same magnitude, or to have a given ratio to one of them. The French, in the very complete reformation of their weights and measures, which they have lately planned and executed with so much ability, have taken for their standard of linear measure, a certain aliquot part of the circumference of the meridian, viz. a ten-millionth part of the quadrant arch of that meridian, a quantity which may
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no doubt be considered as invariable. This standard, however, being difficult to be appealed to, it has been thought better that we should rest satisfied with taking a line accurately compared with the length of the seconds pendulum, which is also an invariable quantity. This being supposed to be done, the principal conditions which ought to regulate the measures of different denominations, seem to be these three: First, they should be all derived from the standard of length or of linear measurement. Secondly, they should be made to depend upon this standard in the most simple way, so that the arithmetical reductions should be made by help of multipliers and divisors, easy to be remembered, and easy to be applied in calculation. Thirdly, in doing all this, the deviations from the common practice, such as now prevails, should be made as little as possible. A standard of linear measure, that shall comply with all these conditions, may be obtained by taking the *foot* preserved in the custody of the Clerk of the House of Commons, which is understood to be to the length of a pendulum, vibrating 60 times in a minute of mean solar time, in the latitude of London, as 12 to 39.13047.

Superficial measure would, according to this arrangement, remain as at present, the chain being 66 of the above feet, and 10 such square chains making an acre; the same acre to be employed both in England and Scotland.

With

With regard to measures of capacity, the direct method is, to take for the unit, either a cubic foot, or some simple submultiple of it. If we were to proceed in this way, and to deviate as little as possible from the present measures, the bushel might be thus determined.

Of the bushel at present in use, of which there are four, all different, and all sanctioned by the authority of Parliament, there is one called the bushel of King William, which contains 2150 cubic inches, and is more used than any of the rest. Now, if this bushel be augmented only by ten cubic inches, the amount will be 2160, which is ten times the cube of 6 inches, or of half a foot, so that this bushel would be to the cubic foot as 10 to 8, or as 5 to 4, numbers which, either for multiplication or division, answer well to the second of the conditions mentioned above. From the bushel, the other measures of capacity, the wet and dry, being the same, will be deduced just as at present. We have next to determine the unit of weight, for which we must have a given bulk of a substance that can easily be procured, always of the same specific gravity. The substance that obviously answers to this condition, is distilled water of a given temperature; therefore the weight of a cubic foot of distilled water, of such given temperature, is to be taken as the standard weight. From this a system of weights, similar to the present, might easily be raised, in consequence of this very remarkable coincidence,

cidence, that a thousand of the present avoirdupois ounces are nearly in weight equal to a cubic foot of water. If, therefore, a cubic foot of water, of such fixed temperature as was thought advisable, were accurately weighed, the thousandth part of that weight might be taken for an ounce, and 16 of these for a pound; the pound, therefore, would be such, that a cubic foot of distilled water would weigh 62 and a half. From this and other multiples and submultiples of the avoirdupois pound might be determined as at present, observing always that no weight but of avoirdupois should be employed, the use of Troy weight, apothecaries' weight, &c. being entirely abandoned.

When this subject was under discussion before the Committee of the House of Commons, it appeared to that Committee, that a method less direct than the above might be more convenient in practice, viz. to determine the measures of capacity from the weights, rather than *vice versa*, the measures of weight from those of capacity. With that view the Committee has proposed, that the avoirdupois weight should remain as it is at present, which it will be allowed to do, if the fixed temperature of the water be taken at $56\frac{1}{2}$ degrees, because a cubic foot of water of that temperature, actually weighs 1000 avoirdupois ounces. The ounce, and consequently the pound, being thus determined, a vessel of such capacity as to contain 80 pounds of water of the above temperature

rature is to be taken for the bushel, which will therefore be equal to 2211.84 cubic inches, and will be about one 36th part greater than the present Winchester bushel of 2150 cubic inches. The gallon will then amount to 10 pounds, or 27.648 cubic inches. The other measures of capacity are deduced from these in the ordinary way. In the end of Dr Wollaston's examination before the Committee of the House of Commons, the measures, according to this determination of them, are thus concisely stated.

One yard of 36 inches is such, that a pendulum of 39.13 inches vibrates seconds in London.

One avoirdupois pound of 16 ounces is such, that one cubic foot of water at the temperature of $56\frac{1}{2}$ degrees weighs 1000 ounces.

One gallon of 8 pints is such, as to contain 10 pounds of distilled water at the temperature of $56\frac{1}{2}$.

The bushel is to contain 8 gallons or 80 pounds of the same distilled water.

There is little doubt, if the authority of parliament shall give effect to this system, and cause it to be universally received, that the greatest benefit will be experienced by all who, either in theory or practice, are interested in the sale or exchange of commodities.

*Savings**

Savings' Banks.

Whatever opinion may be formed of the virtues of the present age, compared with those of former times, those of benevolence and charity must be allowed to belong at least as much to the present as to any other period of the history of Britain. But the feeling of benevolence often counteracts the object it wishes to promote, and leads to a waste of means, without the accomplishment of the end which those means are intended to produce, namely, the bettering the condition, and increasing the comforts of the poor.

Of late, however, since every department of political economy has been studied with the greatest care, and, with reference to general principles, the spirit of charity has been turned into channels of real and permanent use to its objects. It had always been seen how much abuse of the exertions of charity had arisen from the practice of common beggars, obtaining, often under the most false and fraudulent pretences, not relief from want, but the means of indulging vicious propensities. It was difficult, or indeed impossible, for individuals to select the proper objects of their charity, and the natural impulse of benevolence was rather to risk the chance of imposition than to deny relief to genuine distress. Hence, there was unavoidably a misapplication of
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the large funds which such indiscriminate charity supplied, and a great evil to society, from the encouragement which such ill-directed bounty gave to the dissolute and disorderly, which formed so large a proportion of common street-beggars.

To remedy this evil, some benevolent persons had, some years ago, formed an institution at *Bath*, for the relief of real objects of charitable assistance, and the better direction of the donations of the benevolent and humane. In imitation of this institution, a similar one was established at Edinburgh, under the name of *The Society for the Suppression of Street-Beggars*, whose funds, arising from a liberal subscription, and managed with the most laudable industry and attention by persons of both sexes, were directed to relieve the necessities of meritorious poverty, and to afford assistance and support to the needy, according to their real wants, employing, at the same time, the industry of such as were capable of work, in the manner best suited to their different capacities and situations.

This Society, in the progress of its examination into the state of the poor, very soon discovered, that the miserable state of poverty into which some of the common classes had fallen, was often, in a great measure, owing to that improvidence, too general among those ranks, which never thinks of laying up the surplus gain of one day for the support of another,

ther, or of availing itself of the time of health and plenty, to lay up a provision against accident and old age. But improvidence and inattention, they found, were not the only causes of this calamity; it arose, in great part, from the difficulty of finding proper places for depositing the savings of industry.

This inconvenience had been considerably removed by the establishment of *Friendly Societies*, under the authority of an act of Parliament, passed under the auspices of an eminent member, who had applied himself assiduously to this subject, the Right Hon. *George Rose*. But, though much benefit had certainly accrued from the numerous establishments of such societies in different parts of the country, they were found liable to certain objections which lessened their usefulness. The frequent meetings of their members, often frequent in proportion to the inaccurate and unbusiness-like manner in which their proceedings are conducted, occasions a loss of much time; and time, to the persons who usually compose such societies, is money. The stated payments must be regularly made, under the penalty, after a certain time, of the forfeiture of all former contributions; and such payments are of fixed amount, so as not to admit of any variation suitable to the existing circumstances of the contributor; and besides all those inconveniences, the capital of such societies is sometimes altogether lost by ill-secured investment.

Such

Such being the disadvantages of Friendly Societies; and, it appearing to many that one great cause of labourers improvidently spending all their earnings, without reference to future comfort and subsistence, arose from their having no easy, simple, and secure mode of depositing their earnings, the idea suggested itself of establishing, in different parts of the country, *Parish or Savings' Banks*, for receiving small deposits of any amount, such as might suit the actual situation of the parties, and repaying them when desired, with the highest rate of interest which could be afforded. The very great success of these establishments, and particularly of that instituted at Edinburgh, in promoting economy, sobriety, industry, and happiness, induced the Highland Society to inquire into the best mode of framing and conducting them, in order to render their establishment more easy, and consequently more general through the country at large. Their committee, to whom this task was committed, presented to the general meeting of the Society, a detailed report on this subject, pointing out the mode which appeared the best, both for the institution of such banks, and of the management of their concerns, and that of the persons depositing money in their hands, containing also forms for keeping their accounts in the simplest and most commodious manner. This report has been published, and its distribution, which has been made by the Society to different parishes, it is confidently

dently hoped, will lead to the general adoption of this salutary measure.

Celtic Literature and Antiquities.

In the last volume of the Transactions of the Society, its attention to Celtic Literature and Antiquities, which was one of the original objects of its institution, was particularly noticed; and among other measures, to facilitate and promote studies of that nature, that of compiling a Gaelic dictionary was particularly mentioned. During the year 1814, those measures were adopted with more pointed and particular attention. The standing committee, for that purpose, besides having procured the transcription and analysis of the Celtic manuscripts procured at different times by the Society, and now in its possession, which seemed an important step of preparation for such a dictionary, came to the resolution of employing two gentlemen, eminently conversant in the Gaelic language, the Rev. *Dr Macleod*, formerly minister of Harris, now of Kilmarnock, and *Mr Maclachlan*, master of the school belonging to the University of *Aberdeen*, to compile such a dictionary, the former to have the general superintendence of the work, and the latter to assist in its compilation. The Committee drew up a plan which appeared to them best adapted to the proper execution of this design, which will be found in the Appendix,

No.

No. 4; and the two gentlemen above named, sent to the committee specimens of the work, as far as they had proceeded in its execution, with the understanding that they are to continue to report their progress, and to transmit such specimens, at certain short periods, for the perusal and examination of the Committee.

To defray the expence of a work so extensive, the Society, at the General Meeting in January 1814, had voted the sum of L. 145, annually, for three years, in addition to a sum appropriated by Sir John Macgregor, Bart. out of a fund procured by him from certain gentlemen in India, interested in the ancient literature and language of the Highlands. But as this, or any sum which the many other objects of the Society could allow them to appropriate to such an undertaking, could not be sufficient for its proper accomplishment, the Society resolved to open a subscription among its members, and others, disposed to favour a work so important, not only to the Celtic scholar and antiquarian, but to the general advancement of literature all over the world. Such subscription the Committee has now opened, and distributed copies of subscription-papers, accompanied with a prospectus of the work, in every place where an interest in its success, and a desire to promote it, may be supposed to exist. There could not, it appeared to the Committee, be any object more appropriate, or more respectable for the Highland Society, its members, or in general for the members of

of the literary world, to encourage and support; more especially, when it is considered, that from the state of those districts where the Celtic language is spoken and cultivated, the power of accomplishing such an object must daily decrease, and, if attention to it were much longer delayed, would be altogether lost.

Highland Music.

The ancient music, as well as language and poetry, of the Highlands, is one of those national peculiarities, which it is interesting to the antiquarian and man of taste to preserve. The Highland Society has been always solicitous to attain this object, and, in a former volume of its transactions, is inserted a very ingenious account of an ancient Highland Harp, by an eminent musician, *Mr Gunn*. Of late years, some very good collections of old Highland airs have been published by ingenious musicians, who had cultivated that species of melody. Still, however, as the Society has been informed, there are many valuable remains of ancient music to be found in the Highlands and islands, which had not come within the reach of former collectors. Two gentlemen, both allowed to be well qualified for the undertaking, Captain Fraser of Knochie, and Mr Campbell, formerly organist in one of the Episcopal Chapels of Edinburgh, have laid before the public, and submitted to the Society, plans

plans for collecting and publishing a number of those popular airs. These undertakings the Society have agreed to encourage, by subscribing for several copies of the collection about to be edited by the former; and have advanced to the latter, a sum of money to enable him to perform a journey through the Highlands and islands, in pursuit of the object in question.

*Captain Manby's Invention for saving the lives of
Shipwrecked persons.*

At the general meeting in January 1813, the attention of the Society was solicited by a member, to this useful invention, which Captain Manby explained pretty fully at the time, and afterwards shewed experimentally, by exhibiting its performance in Bruntfield's Links, near Edinburgh. The principle was simply that of throwing a rope, by means of a small mortar, over the ship, which is supposed to be lying wrecked on the coast, so as, by means of this rope, to establish a communication with the vessel, by which the crew and passengers may be conveyed to land. The experiment succeeded perfectly. A tree, at the distance of between one and two-hundred yards from the spot where the mortar was fired, was the object representing a wrecked vessel. The rope, to the end of which was fixed a ball of considerable weight, was thrown over the centre of the top of this tree,

tree, and the ball, fixing on the ground at some distance beyond it, kept the rope in that position, so that any person in a ship which the tree represented, could have easily benefited by that communication with the shore, so as to have been saved by means of a cable, a basket, or other means of conveyance. This invention, it is understood, has been actually made use of on several occasions, and answered the benevolent purpose for which it was intended. If the small mortar can be rendered portable, and manageable on board a ship, it must be of general benefit, by affording the facility of employing it from any vessel in the supposed situation, if sufficiently near the shore when stranded, as to be within the range of the shot to which the rope is attached ; even without this improvement, (of which, however, Captain Manby showed a specimen, by lacing the mortar and its apparatus to the back of a sailor, who declared himself perfectly able to manage it even on the shrouds of a ship,) such a piece of machinery, established at different points of the coast most exposed to shipwrecks, would be of great public benefit, and seems to be an excellent accompaniment to the *Life Boats* already stationed at different ports for the same humane purpose. The Society voted a gold medal, with an appropriate inscription, to Captain Manby, as a testimony of their sense of the utility of his invention.

This invention has been since brought before parliament, by Mr George Rose, an honorary member
of

of this Society, and the inventor, on his motion, has received public encouragement and reward by a vote of the House of Commons.

*Public Services, and Distinguished Acts of Heroism,
in Highland Regiments.*

It will be seen, from the introductions to the former volumes, that the Highland Society has been forward, on every proper occasion, to promote the public service, as well as the best interests of its country, more especially by the effective steps taken by the Society at the commencement of the late war in 1803, when this country was threatened with invasion by the person then wielding despotically, not only the government and resources of France, but of a large part of Europe. In the course of that contest, the Caledonians have, on every occasion, nobly upheld the warlike character of their ancestors. At a general meeting, where *Viscount*, now *Earl Cathcart*, Commander of the Forces in Scotland, presided, the attention of the Society was called to the merit of two individuals of the 71st Highland Regiment. It appeared, by a letter from General Ferguson, that, at the battle of Veimera, the French General *Bernier* was taken prisoner by *Corporal Angus Mackay* of that regiment. Mackay's disinterestedness on this occasion was not less conspicuous than his bravery. The French General having tendered to him his watch and purse, with a view

view no doubt of obtaining his liberty, the corporal pointedly declined accepting either, and brought his prisoner to his commanding-officer. To Mr Mackay, who, on the recommendation of the immortal Wellington, had, in the meantime, been promoted to the rank of a commissioned-officer in the service, the Society voted a gold medal, with a suitable inscription. It appeared farther, that *George Clark*, piper of the 71st Regiment, after being severely wounded in the same action, sat on the ground, when unable to stand from the effect of his wound, and played one of those martial and inspiriting strains called *Piobrachs*, to animate his comrades advancing to the charge, which their valour, thus excited, rendered completely successful. To piper Clark, therefore, the Society voted a handsome pipe, properly ornamented, with an appropriate inscription. Those marks of the Society's approbation, were delivered to Ensign Mackay and George Clark, at a meeting of the Highland Society of London, by the Marquis of Huntly, as Preses of that meeting. To this ancient Highland instrument the Society were desirous of paying particular honours; and established an annual Competition of Pipers at Edinburgh, of which their sister Society of Scotland, at their desire, took the management and direction. This circumstance, in the year 1813, led to a communication betwixt Sir John Sinclair, one of the Judges of that competition, and *Sir Rowland*, now *Lord Hill*, under whose command several Highland Regiments were at that time serving in the Peninsula,

Peninsula; on which occasion, that distinguished Officer addressed the patriotic Baronet in the following terms :—

Vieux Mongerie, January 8th, 1814.

SIR,

I have the honour of acknowledging the receipt of your obliging note, transmitting me the report of the Committee of Judges of Highland Pipers, held at Edinburgh in July last, and which I have great pleasure in communicating to the 71st and 92d Highland Regiments under my command. In justice to these distinguished corps, it affords me the highest satisfaction to state, that they have, on all occasions, imitated the example of their warlike ancestors. The conduct of the officers and men, throughout these campaigns, has been so uniformly good, as to render it almost unnecessary for me to select particular individuals for praise. *Lieutenant Colonel Cameron*, of the 92d, does, however, demand that distinction ; during the greater part of the battle of *Vittoria*, he commanded my first *brigade*, 50th, 71st, and 92d regiments ; and also at *Maya*, and other severe operations in the Pyrenees. I am also much indebted to him for leading the gallant 92d in several successful charges, against very superior numbers of the enemies troops, in the battle of the 13th of last month, near *Bayonne*. With the highest respect

respect for the patriotic Highland Society, of which you are so distinguished a member, I have the honour to be,

SIR,

Your very obedient humble Servant,

(Signed) R. HILL, Lieut.-General.

*Death of Mr MACDONALD, Secretary and Treasurer
to the Society.*

During the last year, to which this account of its Transactions relates, the Society had to lament the loss of one of its principal Officers, *Mr Macdonald of St Martins*, its secretary, from its original institution, for a great many years, and afterwards its treasurer, till the time of his death, which happened on 17th May 1814. His merits, in both those capacities, were so conspicuous, and his services so eminently useful to the Society, that it were scarcely necessary to mention them, but for the information of strangers not members of the Society, and for the purpose, at the same time, (a purpose gratifying though melancholy) of recording the Society's gratitude for the unremitting zeal and industry with which he promoted its interests. That these were eminently successful, the present flourishing state of the Society is the best proof; the view of that success, to which he had so greatly contributed, was one

one of the many blessings which the recollection of a virtuous, useful, and well spent life, bestowed upon its close. His memory will be permanently honoured in the recollection of the Society. The honours which at the moment it could pay, it was anxious to show in a manner the most marked and conspicuous. A Committee of its directors was appointed to attend his remains to the Queensferry, on their way to his family burial-place at St Martins, in Perthshire; and the first general meeting after his decease, directed its committee to take such measures as it should deem most expedient, for raising some lasting memorial of his worth, and of the value which the Society attached to his services. It is proposed to obey this instruction of the Society, by erecting a monument, with an appropriate inscription, in the church of St Martins, where his remains were interred.

*Essays for which Premiums have been adjudged by
the Society.*

On several of the useful subjects above detailed, the Society wished for information as to their present state, and probable means of their improvement. For this purpose, they voted premiums of different value, and obtained, in consequence, essays and communications, of which a good many will be found in this volume. Of these the principal treat of agricultural subjects,

subjects, such as an account of the varieties of different kinds of grain best adapted for culture in different soils and situations ; on the nature and cause of the blight or mildew in wheat ; and on the principal recent improvements in Scotland. Others treat of subjects connected with manufactures, such as that of wool. The principles of road-making, though cultivated of late with much success in some districts, particularly in those where Mr Abercromby was employed to conduct them, whose talents, as an engineer in that branch, are of a very superior kind, are still but very imperfectly known in many parts of the country, and on that account, were made the subject of an essay to which a premium was awarded, and which will be found in this volume. Statistical accounts of certain districts of Scotland is another subject for which the Society have awarded premiums, which they mean to extend to different parts of Scotland in rotation, pointing out, in the advertisement for the premiums, those particulars on which it seems most important to obtain information. This, and some other of the subjects above noticed, may appear to have been anticipated by the useful publications of Sir John Sinclair ; but the Society's idea was to promote more detailed inquiry, and to procure more detailed information, on the state and condition of such districts, so as to point out the most probable means of improvement in those articles in which the districts in question had not yet availed themselves of those advantages which their circumstances

circumstances and situation enabled them to command.

One general subject, on which a recent very valuable publication of the above named patriotic baronet, has fully treated, was anticipated by the Highland Society, who, in 1812, awarded a premium of ten guineas to the Reverend *Dr Singers*, for an account of the principal recent improvements in Scotland, which will be found at page 169 of the present volume.

The Society procured from the same Reverend gentlemen, Dr Singers, a paper, partly compiled from various essays by others, and partly the Doctor's original composition, containing suggestions on the best mode of introducing the practice of *wool-stapling* into Scotland, the want of which was felt as a great inconvenience by the Scots sheep-farmer, and lessened very considerable the value of the wool purchased from him by the English manufacturer, which will be found in this volume, page 1st.

In the same way they obtained from the Reverend G. J. Hamilton, minister of Ashkirk, in the county of Roxburgh, a compilation digested by him, on the subject of woods and plantations, their planting, management, and every other particular relating to them, which is also contained in the present volume.

Such

Such have been the principal proceedings of the Highland Society during the period comprehended in this account. They trust those proceedings have, in a great measure, fulfilled the end for which they are sure they were meant, the diffusion of useful information, and the excitement of useful exertion, in matters of considerable importance. The means in their power have been limited; but they hope they have used them with a proper discrimination as to their objects, and a proper selection as to their tendency. If, as they flatter themselves, they shall continue to receive from Government the assistance which for some time past has been allowed them, in aid of their own proper funds, the objects of their encouragement will not be lessened in number, nor, they trust, in importance. They hope to continue such an application of those means, as may keep up the title, which they hope this account of their transactions has shewn, to the public aid and support, in their endeavours to promote, not only the particular interests of the districts more immediately under their view, but the general prosperity of the empire.

22. SEPTEMBER, 1810.

ESSAY AND NOTES

ON

THE STAPLING OF WOOL IN SCOTLAND.

BY W. SINGERS, D. D.

IN the year 1806, the Highland Society offered a premium of Thirty Guineas ‘ for the best and approved Essay or Statement, giving a View of the Advantages which may be derived from the general Introduction of the Stapling of Wool into Scotland ; with a proposal of an eligible Method of accomplishing this Object.’

The attention of the public being thus drawn to the subject, the following Essays were submitted to the Society, and were all in some degree approved, and rewarded with premiums, viz.

1st, In 1806, Essay by Mr HENRY DUNCAN, merchant in Edinburgh.

2d, In 1807, Essay by the Reverend G. J. HAMILTON, Harbottle, Northumberland.

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A

3d, In 1807, Essay by Mr JAMES INGLIS, civil engineer, Parkholm, near Glasgow.

4th, Essay, in 1808, by the Reverend G. J. HAMILTON, Harbottle, Northumberland; the second paper from this gentleman.

5th, In 1808, Essay by Mr JOHN BEATTIE, rector of the grammar school, Moffat. And,

6th, In 1809, Essay by the Reverend WILLIAM SINGERS, D. D. minister of Kirkpatrick-juxta, near Moffat.

To this last Essay, the Society adjudged the full premium; and the Committee of Directors ordered it to be printed in the fourth volume of the Society's Transactions.

But, as the other Essays also contained useful matter, which the Directors wished to be selected from them, and arranged and incorporated along with the Essay No. 6. they were pleased to commit this business to the author of this last Essay, to be done in any form that he should consider most proper for answering that purpose.

With this view, all these Essays were sent to him; and also a copy of some letters and correspondence on the subject of Wool Stapling, dated in 1810, from a merchant in Edinburgh to the Secretary of the Society, and from two gentlemen near Leeds, to one of the Directors.

With these Essays and Papers, two letters

from the Depute-Secretary, dated 9th June and 23d July, 1810, were transmitted, explaining for what purpose they were sent, and referring to the Paper on the Diseases of Sheep, which was compiled by Dr ANDREW DUNCAN junior, Professor of Medical Jurisprudence in the University of Edinburgh, on a similar plan, from ten different Essays on that subject, and published in the third volume of the Society's Transactions in the year 1807.

To this confidential commission of the Society, the compiler of the following paper has been more anxious to do justice, than satisfied of his fitness for the work. In one view, it was delicate ; but this did not appear to furnish a sufficient reason for declining the task, and the honour assigned to him. He has reperused and written out his own Essay, with additions ; and has also gone over all the others repeatedly, making notes of their contents ; and inserting extracts, or the substance of such parts of them as appeared proper to be selected, in order to answer the views of the Committee for Publications.

The same thoughts occurring not unfrequently in different Essays, it was not thought necessary to quote more than one ; and the authors of the other Essays will pardon the Compiler for omissions of this description, which the nature of the trust committed to him rendered unavoidable.

ESSAY ON THE STAPLING OF WOOL IN
SCOTLAND.

By the Rev. WILLIAM SINGERS, D. D.

With Notes and suitable References from the Writings and Essays
abovementioned.

INTRODUCTION.

THE art of assorting wool is the first thing to be learned, with a view to the manufacture of it; and it cannot be expected to flourish in any country, unless there be a market for the assorted commodity. The stapling business ought, therefore, to be considered as embracing both the sorting and selling of wool, and as connected with the future process of manufacturing it.

The wool stapler, in the ancient sense of the term, was rather a merchant than an assorter. At present, the stapler very commonly both assorts and sells; and sometimes we find him also a manufacturer.

Most of the staplers of Great Britain reside in England. This is natural; for most of the manufacturers also reside there. The stapler pur-

chases wool in the fleece, and in quantities ; and having assorted, or stapled it, he supplies the manufacturers with wool of any degree of length and fineness, and in any quantity required. In this view, the stapler is a middle-man, having business with the sheep-farmers in the first place, and, next, with the woollen manufacturers. To both of these classes he is useful ; and as his business requires a considerable extent of capital, and not a little skill and enterprize, he is entitled to a corresponding profit.

Before the staplers of England extended their transactions into Scotland on a liberal scale, the growers of wool, there, were not happily situated in respect of markets. A set of inferior dealers purchased their wool, and retailed it, the best way they could, in the neighbourhood. The prices were low, and the payments not good. It must not be denied, therefore, that the storemasters of this country have been indebted to the staplers of England. The spirit and wealth of this body of men are now very considerable. The stapling business and woollen manufactures in that country, are immensely extended ; and mutually support each other. Capital is more easily acquired, as money and credit extend themselves by various means. Commerce enables England to find markets for manufactured goods ; and the skill of her workmen, and use of machinery, have enabled her to work up the raw material in the most perfect manner.

It is evident that Scotland, as a part of the British empire, must, eventually, derive advantage from the prosperity of England : and, in respect of wool, she has been a gainer, directly, by the regular sales and increasing prices ; not to mention various indirect channels, in which also Scotland derives benefit from the woollen manufactures of England.

This mutual advantage derived from the one country to the other, promises to extend and consolidate, in proportion as the wool of foreign nations shall cease to be employed ; while Scotland rears it with more care, and England finds her supplies in more perfection within the kingdom, and at lower prices than such as are paid for imported wool.

But though the trade in wool within Scotland continues to extend and to improve, the wool growers complain that they have become too dependent on the staplers of England, not only for the sales and prices of their wool, but also for the times and modes of payment.

Landholders think that the existing mode of purchasing wool has a tendency to prevent attention to the purity and improvement of the pile.

Persons in Scotland wishing to purchase a few fleeces or stones of wool, complain of the stapler as an engrosser of the trade, because they cannot be accommodated with facility at home, the storemaster not wishing to break his clip in order to supply neighbours even with fleece wool ;

and no market existing, in this northern part of the kingdom, for wool duly assorted.

And the public find, that while the manufacture of cotton is extensively carried on in Scotland, that of wool is very inconsiderable, compared with the quantity of raw material which is grown among us, and with the demand for, and use of, manufactured goods.

If these complaints be not well founded, they must be pronounced illiberal, and ought to be discouraged. But if there be a real foundation for them, it ought to be made appear; and the legitimate remedies would then fall to be considered.

PART FIRST.

ON THE REQUISITES FOR, AND MODE OF STAPLING OR ASSORTING WOOL.

THIS valuable and necessary art is most correctly practised in England, and to the greatest extent. Stapling paves the way for manufacturing; and forms, in fact, the first step. The long continuance and extension of manufactures, refined by improving taste for the more perfect fabrics, have a tendency to render every part of the process, and especially the first part (the stapling) more correct. In England, this business is not only more perfect than in other nations, but it is greatly improved of latter years.

The stapling of wool in other nations is rather foreign from the objects and design of this Essay. It is said, that the Spanish mode of assorting wool is extremely inaccurate, notwithstanding the superior value of the pile. It is observed by a gentleman, in his correspondence with the Secretary of the Highland Society, ' That Spain does certainly assort her wool; for, in

‘ the assorted state, it is packed in bales, and sold by marks and letters ; coronet wool being ‘ of the finest quality,’ &c. But it appears (from Luccock on Wool, pages 140, 141, and from other authors quoted by him), that the Spanish mode of assorting is only to tear the fleece across the loins, take off the skirts, and divide the remainder into three parts, without nice discrimination ; ‘ a lazy and artless operation, as that author styles it.’ In fact, Spain having little encouragement for manufactures, and her wool, in commerce, being readily purchased at prices which are probably far too high, in consequence of the character of the pile, and the anxiety of the trade to obtain a full supply of it, in the present state of that distracted kingdom, this account of the mode of assorting ought not to surprise us. The wool of Spain is fine, but her mode of assorting imperfect.

In France, there is said to be a greater degree of attention to this art. But it is perhaps more speculative than practical : and at any rate, it is only the local effort of a nation for its own accommodation ; or the political object of a rival power, who has been deprived almost entirely of the advantages and powerful stimulus arising from commerce, and tending to the perfection of the subsidiary arts.

In Scotland, there is no moral or physical cause to prevent the stapling and manufacture of wool on an extensive scale. The raw material

is produced in great abundance ; there is an extensive demand for woollen fabrics in the country ; and the channels of commerce are open to the people. It may be asked, then, why these important arts have not been carried to a greater extent ?

The Reverend G. J. Hamilton, in his Essay 1807, observes, ‘ that by the introduction of ‘ wool stapling, (by which term, in that Essay, ‘ he also means the manufacture of wool), a great ‘ expense incurred by transporting the material ‘ would be saved. There appears,’ says he, ‘ to ‘ be a very glaring absurdity in the general mode ‘ of managing Scotish wool. The Reverend Mr ‘ Headrick, in an excellent paper on Improvements in the Highlands, published in the second volume of the Society’s Transactions, ‘ gives the following curious and correct account ‘ of the various expeditio:ns of the raw material, ‘ before its final conversion into cloth. It is, ‘ first, he observes, sent into England to be sorted and combed ; part is returned into Scotland ‘ to be spun into yarn ; the yarn returns to England to be weaved, dyed and dressed ; a great deal of the cloth returns back, to be worn by ‘ our own people ; who do not perceive that, by ‘ a little ingenuity and labour, the raw material ‘ might be raised in value, and that the great expense incurred by its transit from place to place ‘ might be saved. When the numerous streams, ‘ the powerful waterfalls, and the infinite variety

' of eligible situations that abound in Scotland
' for the erection of woollen manufactories, are
' taken into consideration, the absurdity of the
' mode of management above described must
' strike every impartial observer with overwhelm-
' ing conviction.'

Nothing indeed could be more absurd, if the situation of Scotsmen, and the produce of their soil, were equal to those of England. But, in various respects, this was not the case in former times; nor is it exactly the case at the present time.

The wool of Scotland, till a late period, and for many years preceding, was mostly of the heath or short sheep, and of the very coarsest quality. It was adapted only to the hardest fabrics, least capable of repaying the trouble employed in manufacturing it, and scarcely affording encouragement for a perfect assortment. The demand at home has been rather for goods of the finer wools; and until Scotland furnished wool of a corresponding quality, answering the public taste, she had not so much encouragement, either to staple or manufacture. England, at the same time, was in possession of the arts, and of the commerce, in wool.

Now that a large quantity of Cheviot wool is grown in Scotland, capable of being carded and spun into cloths of good quality, very suitable to the improving taste of the country; and that a still greater quantity of the coarse wool of short

sheep, fit for carpets and inferior cloths, is also grown : While parcels of long-woollen sheep are introduced in various places, furnishing wool for combing ; and the finest woollen breeds of England and Spain are finding way into the country, and amply repaying the care employed about them, by increasing prices for their valuable pile: While the raw material is thus rapidly increasing in quantity, and improving both in quality and in variety, there can be no doubt that wool stapling and manufacturing will follow, and that, after a competent time for acquiring skill, the genius, patience, and industry of the inhabitants will be found equal to the undertaking.

A mercantile gentleman ascribes the want of these arts in Scotland to ‘ the want of capital, and of great wholesale merchants and staplers; to the want of particular places making only one particular article ; and (perhaps) to the selling of premium cloths to private individuals ! ’

Some of these obstacles are undoubtedly relevant to impede or obstruct the stapling and manufacture of wool in Scotland ; but not, we hope, to prevent them. There is a comparative want of capital, and of subdivision of labour ; but these are not absolutely wanting ; for the genius of our people is not inferior. Capital is employed largely in other branches of business ; and it would naturally pass into this favourite channel, if circumstances were sufficiently inviting.

What effect the selling of premium cloths to individuals may have, does not clearly appear. Though it were admitted to excite jealousy, and to discourage the cloth-merchant, these effects could only be supposed to correspond with their cause; and this being insignificant in point of extent, so also, it would seem, ought its effects to be.

But when we consider England in possession of the arts and of the trade in wool; superior in every part of them; in exclusive possession of the first branch, that of assorting; having the raw material in full variety and perfection within herself, excepting the requisite supplies from Spain; acquainted with all the uses and powers of machinery, and with the best markets in all quarters; having full command also of credit and capital:—And then, when we consider the situation of the people of Scotland, in all these respects,—too many, and too natural causes may be discovered for her comparative deficiency in the manufacture of wool.

At the same time, while the raw material improves, and the people are capable of acquiring skill to assort and work it up; while an extensive home trade opens to invite us, within this part of the kingdom; and the spirit of commerce, and the national genius, are as free as in England; and while capital is found for every other purpose, and this most natural and inviting object seems to press on the public attention, almost a-

bove all the rest ; it cannot be conceded, even to England, that she has any claim of an exclusive description. Her superiority, a Scotsman will not deny ; but he may surely maintain his country's right to follow, according to circumstances, the steps of England in this path towards wealth and distinction.

The transit of wool from Scotland into England, for many years, has been indeed very great; but still, the supplementary stores thus furnished are very inferior to the home supplies that England has within herself, even in point of quantity, and still more in respect of quality and variety. In these particulars, as we approach nearer towards the state of England, we certainly possess growing inducements to become staplers first, and then manufacturers, on a suitable scale.

In England, the art of stapling is correctly learned, by serving a time to it ; and the business is encouraged by liberal wages, and regular employment. Every necessary accommodation is provided for the operative staplers ; and commerce, encouraging diligence and accuracy, all concerned find their reward,—first in the markets for stapled wool, and next in those for manufactured commodities.

In Scotland at the present time, and in various places, machinery is in use for teasing, carding, and rowing of wool ; and there are also jacks and jeanies for spinning it : and, in some cases, worked mills for spinning and twisting of long wool.

It is found that manual labour comes too high ; and for the above purposes, the use of machinery, even in Scotland, has been greatly extended of late years in comparison with former times.

With a view to prepare the wool for these purposes, a rough and imperfect assorting is made of it at the mills. A fleece is divided, by hand, into three, four, or five parts, according to circumstances.

Private individuals employed in working up wool, are sometimes induced to follow a similar imperfect mode of assorting it ; and, in certain manufacturing houses, a greater degree of attention is paid to this process.

But the art of stapling wool, correctly, by means of persons who have served an apprenticeship to it, and the sale of wool thus correctly stapled in the country, by men regularly bred to the business, are not known in Scotland.

And, very probably, we ought to ascribe to this deficiency in the first process, that comparative decline in the woollen manufactures of which the Scots complain. For, while the radical process is mostly unknown, or performed imperfectly by persons not correctly bred to it in this country, and while every branch of the working of wool, and this in particular, are improving and perfecting in England, the superiority of the one part of the kingdom over the other must be always on the increase.

Large buildings being provided for the stapling

business in England, the packs containing fleece wool are generally stowed below, and taken up, when wanted, by means of proper tackling.

Attendants unroll the fleeces; and all impurities being cut off, and the fleece being spread out before the operative stapler on his table, and the dust or sand being shaken out by him over the fine meshes of a netting of iron, the assortment commences, directed jointly by the eye and the hand. Different sections are made out of one fleece, by teasing off the coarser parts from the finer, and separating each variety into a light basket, with a suitable mark. The actual separation, and also the principles on which it is made, by long practice, become easy; and the various baskets which were placed round the workmen, when filled with stapled wool, are emptied into others of a larger size, or into packages or apartments bearing the same number or mark.

The perfection of stapling depends on the uniformity of the pile in each basket or package of stapled wool, and in there being a real difference betwixt the pile of one basket and that of another.

And farther, provided that such a difference can be marked, the more sorts that are made, the more perfect is the work.

It is a great object with the stapler, to make out as much as possible of the varieties which are fine. The coarser varieties, when stapled, are expected to bring as much per stone as the wool

in general cost when in bulk. The finer sorts being sold at a much higher price, the stapler's profits are expected chiefly from them.

No definite number of divisions has been, or can be fixed. The custom of regular staplers has varied, from six to nine, or thereby. A pile of fleeces is capable of a larger number of sections than a single fleece admits of. The manufacturer who staples his own wool, adapting it to the several purposes of his business, divides the wool into a few sorts, perhaps four or five. The stapler who means to divide for the public, assorts into as many parts as admit of distinction, that he may suit the various demands and views of those who purchase. The terms employed for the different sorts vary, in different lines of business and places. They also discover a gradual progress in the distinctions made of the finer sorts.

Mr Luccock, woolstapler in Leeds, in his work on wool, 1805, has given these terms, and a comparative statement of their fineness, reckoning in parts of an inch.

No. 1. Short coarse	.	.	.	.	.	—
2. Livery, in parts of an inch					600	
3. Abb	.	.	.	.	.	—
4. Seconds	.	.	.	.	800	
5. Downrights	.	.	.	.	920	
6. Head	.	.	.	.	1000	
7. Superhead	.	.	.	.	1160	

No. 8. Picked lock	.	.	.	1280
9. Choice lock	.	.	.	1400
10. Prime lock	.	.	.	—

This table, though not complete, affords some degree of satisfaction; and is given by the author alluded to among a great mass of information on the subject of wool, and especially of British wool.

It deserves attention, that when the diameter of the pile of one sort is double that of another and finer sort, supposing the filaments equally long, the same weight of the finer sort would extend in line four times as far as that of the coarser; allowing the specific gravity of equal bulk in filament to be the same. In this view, a pound of picked lock ought to extend farther in line (and therefore to work out longer in yarn) than a pound of livery, in the proportion nearly of 107 to 36. In the same view, the superiority of moderately fine Spanish wool, stated at 1700, over short coarse, which is much below livery, may be conceived from the proportional length of the filaments, (taking equal weights of each sort), perhaps at 16 to 1: And in nearly the same proportion must be the fineness, and perhaps also the softness, and the capability of being wrought up into yarn.

But, as it has not been ascertained what the proportional specific gravity is, we cannot indeed compute with certainty from it. We may, how-

ever, be allowed to presume, that the specific gravity of wool, approaching towards hair in the pile, is greater than that of a finer texture and pile: And if this conjecture be right, the difference in favour of the finer wools is still greater.

The wool of heath or short sheep, in the hands of some staplers, undergoes a curious operation. The stapler finds the points of the hair so coarse, as to spoil any goods into which the wool can be wrought by him. He, therefore, when the fleece is opened, causes the workmen clip off above half an inch off the points. The remainder of the fleece is found not so harsh in working up.

To enable one with ease and accuracy to subdivide wool, in the correct mode of the wool-staplers of England, an accurate eye and delicate hand are requisite—accustomed to precision by long habits of attentive working.

It would, perhaps, be more intelligible for the public, if stapled wool were all known by simple numbers, and separate marks for long and short—and if the technical expressions in use were laid aside. We should not then hear of any thing but the number of sections; and if these were in due regularity, they would be more clearly distinguished by simple numbers, than by any other mode.

Mr Henry Duncan, merchant in Edinburgh, who mentions in his Essay that he was thoroughly bred to the stapling of wool, by a man of the first

abilities in that line, has the following observations in that Essay, viz.—

‘Stapling, or sorting of wool, is of the greatest utility and advantage to the manufacture of woollen cloth, as it is the first operation. Wool grows upon the sheep in a regular degree of coarseness from the head to the hip; and in the finest parcel of wool, there is always some coarser than others. By stapling, the fleece is divided into five or six different parts; which ought all to differ in fineness by a regular gradation. According to this plan, every fleece gets its place according to its fineness; and every part of the fleece according to its quality. This is the only, and the whole foundation, of the presently high and improved state of the woollen manufactures.

‘The best and most approved method of stapling wool, is to have a large room (with a clear light) fitted up with six different apartments in it, to contain the wool when stapled, marked Nos. 1, 2, 3, 4, 5, 6; and a large table, upon which the stapler must have easy access to throw his wool, and assort it, for the different numbers and apartments.

‘He takes hold of the fleece, and unrolls it regularly on the table, and by the clear light he examines it minutely, beginning at the head end, which is the finest, and observing how far that fineness goes down the fleece; taking hold of the top of the staple of wool with the force

* finger and thumb of his right hand, and pressing with his second finger upon the middle of * the length, which makes the fineness clearly appear upon his finger. Where the staple alters in fineness, he breaks off what was of one sort, and throws the wool into the corresponding number; breaking off parts wherever the staple perceptibly alters, till he go down to the wool of the hip, which generally goes to No. 6.'

Mr Duncan, in this account of stapling copied from his Essay, partly verbatim, and partly in substance, gives a clear view of the operative part of the business, as he himself appears to have seen it conducted. But many staplers make a greater number of sections than six.

He adds, on the subject of the advantages of stapling—‘ The first great advantage is the taking the fine wool out of the coarse; it is like taking silver out of lead. The coarse wool is nothing worse for the fine being taken out of it, but manufactures equally well. The fine, on an average, is worth five or six times the value of the wool out of which it was taken, (pound for pound); and numbers 1 and 2 of assorted wool are worth more than all the rest. The consequence is, that the wool, by stapling, becomes more than doubly valuable.

‘ The second advantage of stapling wool, is the uniformity of the pile in any one number; which being so nearly matched in fineness and

' length, harmonizes in working up, and in every operation.'

' The third great advantage of stapling, is an open market of assorted wool, suitable to all purchasers, rich and poor, and to every purpose they may have in view. This benefit is particularly valuable to poor manufacturers, who can thereby take an order for any piece of any quality, and purchase wool for that piece, or even for an end. This facility of correct markets, on any scale wanted, has been of great use to the trade, by means of the poor, but industrious, manufacturers in England.'

To these very sensible and just observations from Mr. Duncan's Essay, it may be proper to subjoin Mr. Inglis's plan for marking and numbering the assorted wool.

' The mode of sorting wool (says he) is very different in different manufactories, particularly with regard to *sorts*, (numbers of sections). This entirely depends upon the goods made; some divide it into three sorts, some into nine, and others into twelve and fifteen; but in this I would (recommend to) adhere to one rule, that all may have the same encouragement.'

' I would first divide the parcel of wool into three kinds, fleece by fleece. The fine I would mark A; the second B; and the third C. This being done, I would take each fleece, and divide it again into three kinds; the fine I would

' mark $\frac{A}{1}$; second $\frac{A}{2}$; third $\frac{A}{3}$: the wool mark-
 ' ed B, the fine $\frac{B}{1}$; second $\frac{B}{2}$; third $\frac{B}{3}$: the wool
 ' marked C, the finest, $\frac{C}{1}$; second $\frac{C}{2}$; third $\frac{C}{3}$.
 ' By this method, the finest wool is marked $\frac{A}{1}$,
 ' and the coarsest $\frac{C}{3}$.
 ' It may also be sometimes necessary to divide
 ' into two or three kinds with respect to the
 ' length. When this happens, it will make other
 ' three kinds; long L, middling M, and short S.
 ' The marks in this case would be, L $\frac{A}{1}$, M $\frac{A}{2}$,
 ' S $\frac{A}{3}$, &c.

Whether every fleece could properly be thrown wholly into one of three kinds, and then subdivided correctly into three portions, is not quite certain, though in general it might be done. If it could, Mr Inglis's mode of marking and numbering would deserve attention, as it seems to be simple and ingenious; and his idea of the propriety of one general mode of marking is undoubtedly good. Perhaps, after the subdivision of wool, according to the length, into Long, Middle, and Short, (or perhaps simply into long and short, according to the circumstances), all the rest of the marks ought to be taken from the cardinal number, in regular order, answering to

the varying shades of the pile in respect of fineness alone.

Other properties would fall to be discovered by sample and inspection ; such as purity, colour, smell, curvature, and the like.

Mr Inglis has transmitted a plan of what he considers to be a proper house for stapling, accompanied with a description, in the end of his Essay ; to which plan and description reference may here be made.



PART SECOND.

ON THE PRESENT STATE OF THE TRADE IN WOOL,
IN SCOTLAND.

THE quantity of wool grown in this northern part of the kingdom has increased very much, as the sheep have extended themselves over the hills of the north ; and it is now so considerable, as to form one of the principal articles of export from Scotland. Short sheep still occupy the greater part of the sheep walks of this country ; and the coarse wool of this hardy breed continues to be in greater quantities than any other sort. Yet the Cheviot breed, though more hazardous in the lambing season, and not considered such kindly feeders, have been so extensively introduced, of late years, on account of their fine fleeces, that a considerable portion of Scottish wool is now of this description.

Of long woolled sheep the numbers are small, in comparison with those above mentioned. Superior managers, who are at pains to provide

rich grass and plenty of turnips, are in possession of small flocks of the new Leicester breed. And though the race of Muggs are not yet entirely given up, as pets, to feed among cows, the number of them is less than it was; and it never was large.

If we admit that Shetland sheep are not on the increase in point of numbers, it is morally certain, that wherever they are kept, a greater degree of attention will be paid to them: And as the race of the South-Downs and Spanish Merinos are undoubtedly introducing and extending themselves, it may be safely concluded that the fine wool of Scotland is becoming every year more and more considerable.

The number of mills for teasing, carding, and rowing of wool, increasing in Scotland, and also the use of machinery for spinning it, would seem to indicate an extension of the woollen manufacture in this part of the kingdom. But the fact seems to be, that, with some few exceptions of particular places, this most important business has greatly declined. These mills have been sometimes employed in furnishing woollen yarn to the manufacturers of England; and, to a certain extent, they are employed by the people of this country in order to abridge the labours of the hand, and to furnish more equal and perfect work. But thousands of families, who used formerly to manufacture most of their cloth and blankets at home, (spinning the wool in private

houses, and then sending the yarn to some neighbouring weaver,) have now given up all concern in these matters, and depend entirely on the cloth and flannels of England. Even the hose trade, which, in the north-eastern districts, was at one time very flourishing, is now much decayed, knitting by hand having become too expensive to contend with the loom.

It ought not to appear surprising, that many of the branches of woollen manufacture have not succeeded in Scotland so well as in England. It was necessary to import most of the combing long wool from England ; and, except of late years, most of the carding fine wool also. The markets of England being long frequented and better known, and capital being invested, and machinery employed at an earlier date, and to a larger extent, the sales and trade, as well as the skill and powers, were all in favour of that country.

In addition to these causes of decline in the woollen manufactures of Scotland, the want of regular and correct stapling of her wool has operated as a fatal bar in her way : And it has not only prevented the success of the manufactures, but it has also greatly injured her trade in wool. In fact, the greater part of it is exported into England, and stapled and manufactured there. Skin wool, pulled from the pelts of sheep that have been slaughtered, or have died of distempers, together with a proportion of the fleece wool of the country, and some wool imported, is

wrought up within it; but the great mass of shorn wool goes in packs and fleeces into England.

The wool stapler purchases, either in person or by commission. He takes the whole clip of the several farmers with whom he deals; and therefore he expects that no fleeces are to be selected for private sale. He generally continues to deal from year to year; and the state of the trade is often secret, no samples being shown, and the prices not commonly divulged. Indeed, the staplers' agents hardly look at the wool till it is ready to be weighed; and in Scotland, wool markets are few in number, and only recently established.

This general sale of wool, unseen, and without sample, is obviously unfavourable to improvement in quality. The stapler gives nearly the same price for all the wool of one name; though the pains taken in washing and putting up may have been different, and though, in the natural quality also, there may be some distinction. The farmer's main objects are to ensure a sale at the current prices, and to have as many stones as possible in the market. Accordingly, little or no improvement is ever made, or even thought of, in the quality of the wool of short sheep; and though a greater degree of attention is paid to the wool of the Cheviot breed, still there is no suitable encouragement for honourable attention to purity and improvement in the pile; There

can be none,—so long as wool continues to be sold in quantities, without samples, in a secret manner, and without accurate inspection by competent judges.

When the fleeces are clipped off the sheep, they are, one by one, rolled up, with the inside turned out, and stowed in a barn or convenient house, to wait the orders of the purchaser for packing up, after being first weighed in stones. If all impurities be not taken away when the fleece is clipped and rolled up, and if this operation be not performed when the wool is perfectly dry, the purchaser undergoes loss and imposition; and the same thing happens, if the wool be not stowed in a dry and clean place.

As most of the flocks in alpine situations are smeared or laid with a mixture of tar with butter or oil, it is of some importance for the staplers to know in what manner the sheep have been laid. In the Southern walks they are all smeared; but in the Highlands, only a part of the flock. Short sheep are smeared more heavily than Cheviot stocks. It is considered a good sign of short sheep when they look dark; as the purchasers imagine they have been reared on mossy walks, and expect them to turn out hardy. Farmers, knowing how much the tar adds to the weight of the fleece, allow their short sheep to be smeared perhaps too heavily; for a less quantity of tar answers the Cheviot breed, and on these it is laid with greater care.

Some storemasters cause their sheep to be well washed, by sending them repeatedly through proper pools of running water, some days before clipping. Others perform this operation in a less perfect manner; and some neglect it entirely. When it is performed in such a way as to separate earth and sand from the fleece, and to wash off other impurities, it is of essential service to the purchaser. But it often happens to be inconvenient for the farmer to find proper washing places; and this operation is, for that and other reasons, very unequally performed by different men.

The stapler or his agent attend, for the most part, when the fleeces are to be weighed; and this being done, they are packed in bags containing each about 12 stones of 24 lib. avoirdupois. These packs are properly marked and numbered, and are then left to be conveyed to England in the most convenient way.

Agents, carriers, or shipmasters, to whose care the packs are entrusted, not being always provided with convenient places in which to deposit the wool before the removal of it, or its final delivery, frequently allow it to lie out in the open air till the bags are greatly damaged, or even rotted.

For all these losses, arising from imperfect management, from the time of smearing the sheep down to the delivery of the wool in the stapler's own storehouses, it is easy to see that the general trade must pay. The purchaser calculates on

losses and imposition, and regulates his offers accordingly. The woolgrowers pay for these things in their general trade. A large proportion of Scottish wool passes into the manufacturing counties of Yorkshire and Lancashire ; and the returns are in bills, payable from six to twelve months after delivery.

It has often been said, that the staplers may and do combine to keep down the price of wool. Certain it is, that no class of traders do business more prudently ; and that many of them realize considerable fortunes. When markets are brisk, there may be less truth in the stories of their combining ; but, in other circumstances, especially in remote situations, the farmers cannot, without uneasiness, miss their accustomed merchant ; and if they find it difficult to sell on better terms to another, or to store it for another year and want the price, having no public markets to try, what can they do but sell, even at an inferior price ?

If the farmers were able to staple their wool, and to sell it directly to the manufacturers, it is obvious that a larger price ought to be drawn, and also that immediate encouragement would be afforded for attending correctly to the quality and purity of it. In this view, the farmer and the landlord have both of them an interest in the introducing of regular stapling into Scotland.

In another view, this art appears of still greater importance to the community. It has been

observed, by persons of superficial modes of thinking, that we cannot expect a market for assorted wool, for want of resident manufacturers in Scotland. But this want is not so much the cause of our wanting stapling, as the consequence. We cannot manufacture wool to purpose, nor with the prospect of advantage, till it has first been properly stapled : We cannot, while ignorant of this art, contend with others who are well versed in it : No art can prosper without subdividing the labours, and arranging the materials employed in it. If stapling were introduced, the correct manufacture of wool would gradually and naturally follow.

What can the Scottish manufacturer do, in the present state of the trade in wool? He cannot be expected to understand correctly the art of assorting, and therefore is incompetent to that of manufacturing. The trade will not bear the expense of sending the packs to England, paying the stapler there an exorbitant sum, and then bringing back the wool after it has been assorted ; neither could he afford to bear the risk and the delay. He must therefore either manufacture his wool when less correctly assorted than it ought to be, or turn his attention to some other branch of business ; leaving the manufacture of wool to Englishmen, who understand the art of assorting it in the first place.

Whether the profits of the wool-staplers be too high, or how far they are so, it is not easy to ascertain with certainty. Some have computed

their average profits at 30 per cent., and others at a rate much higher. In such a business, the profits ought to be liberal ; and if they were not, we should not find so many people embarking in it, and seeking to extend their transactions. But when it is considered how long the staplers take to pay their wool, such a per centage is undoubtedly too high. Whatever may be thought in this respect, it is evidently the common interest of the farmers in Scotland, and of the manufacturers of England, to reduce the stapler's profits to the fair proportion, by opening a commercial intercourse with each other, or by employing workmen for wages to staple a part of their clip, and brokers or agents to sell the stapled wool, at a low and fixed allowance, instead of selling all in bulk to a dealing stapler, whose profits are large and undefined.

Yet this inviting measure is not the most important in view. It ought to be connected with others, and especially with a system tending to improve the purity of wool, and the quality of it also, to a proper and safe extent. It should be an object, to give every degree of facility to the sale of it ; and to introduce the woollen manufacture to a much greater extent in Scotland.

In the year 1805, an English woolstapler computed the whole wool of England and Wales at 893,236 packs, as the annual produce from above 26 millions of sheep and lambs : and the value of

the whole he estimated at about five millions and a half Sterling.

In Scotland, the computations of the numbers of sheep have been made at about eleven millions; and, supposing a stone of wool from every six of them, it follows that above one million and eight hundred thousand stones of wool are annually grown, being above 150,000 packs. If we suppose one-third of this to be Cheviot wool, and two-thirds coarse wool of short sheep, and estimate the former at 30s. per stone, and the latter at 10s., it will appear that above a million and a half Sterling are drawn in Scotland, annually, from wool the produce of the country, as raw material.*

And if the supposition be right, that three-fourths of this wool are sent into England, in order to be stapled and manufactured, the value is considerably above a million Sterling; and 80 per cent. on this last sum, would amount to above £300,000 as the annual profits of the staplers from Scottish wool, on the lowest computation.

But if it be true, that the value of wool is quadrupled by manufacturing it, then it must be admitted, that three millions sterling a year are divided among the staplers and manufacturers of

* Prices have altered since 1810; Cheviot wool having fallen, and being now again on the rise, while coarse wool has been higher.

England, and others employed in the preparation and sale of woollen goods, in order to cover expense, and to indemnify them for labour and risk, for Scottish wool ;—a sum which, divided among the parishes of Scotland, would exceed £3000 a-year for each.

The reverend G. J. Hamilton, in his Essay written in 1808, has presented the Society with the following statements, viz.

' The whole quantity of wool grown in England has been frequently estimated. In the time of Ellis, it was computed that Great Britain produced yearly 500,000 packs, and Ireland 300,000 packs.

' In the beginning of the last century, according to Davenant, England alone produced 400,000 packs.

' Trowel, about half a century later, estimated the united produce of the three kingdoms at about 925,000 packs. The indefatigable Mr Arthur Young, secretary to the Board of Agriculture, calculates the value of the whole growth and labour of the wool of Great Britain and Ireland at about seventeen millions; and Sir John Sinclair (including the value of the wool imported from Spain), at twenty millions Sterling annually,' &c.

' On a subject of this kind, where the most eminent calculators differ, only general opinions can be formed; but from taking an average of

the most accurate estimates of the whole quantity of wool grown and manufactured in the United Kingdom, with other data which the writer of this Essay has been at some pains to collect, he ventures to subjoin the following statement in general numbers, as perhaps a near approximation to the truth. The total number of wool-bearing animals in the United Kingdom may amount to about 30 millions; and supposing each sheep, at an average of the whole, to produce five pounds weight of wool, the whole quantity produced in Great Britain and Ireland will be 150,000,000 pounds weight, or 625,000 packs; which, at one shilling per pound, or twelve pounds Sterling per pack, amount in value to £7,500,000. And by quadrupling the above sum, for the labour bestowed in manufacturing, we have the sum of £30,000,000 Sterling as the gross produce of the wool grown on 30 millions of sheep, (including prime cost and labour in working up.)

The same author has the following observations and statements in his Essay, viz.

The general introduction of the stapling, or sorting of wool, into the sheep districts of Scotland would entirely preclude the necessity of importing the fine wools of Spain. This would be a benefit of the first importance to the country, and would furnish a large portion of our population with employment in working up goods and cloths of the first excellence, from fine wools of

our own growth; which are most in request both in the home and foreign market, and afford the largest returns for the capital employed. It is well known, that the finer fabrics require a much larger proportion of hands than those of an inferior quality; bring a larger capital into circulation; and, by consequence, more essentially promote the best interests of the state.

The value and amount of Spanish wool imported into this country for the ten years immediately preceding 1790, will appear from the following authentic statement, viz.

** Spanish Wool Imported.*

Ans.	Pounds weight.	Value.
1780	- - 323,618 at 5s. per lib.	L. 80,904 10
1781	- - 2,478,332	619,583 0
1782	- - 991,510	247,877 10
1783	- - 2,629,692	657,423 0
1784	- - 1,602,674	400,668 10
1785	- - 3,135,252	783,813 0
1786	- - 1,554,637	388,659 5
1787	- - 4,188,252	1,047,063 0
1788	- - 4,173,584	1,043,396 0
1789	- - 2,693,889	673,472 5
<hr/> Total for 10 years		L. 5,942,860 0.

Postscript from the same Essay.

Since writing the above, the following accurate statement of the whole quantity of wool

' imported into the kingdom, has been received through Lord Sheffield, viz.—

Anno.	Pounds weight.	Value.
1800	- - 8,500,000 lib. at 5s.	L.2,125,000
1806	- - 5,964,672	- - 1,491,160
1807	- - 11,760,000	- - 2,940,000

' The average of importation for these three years, is 8,741,557 pounds weight of wool each year, valued at £2,185,386 13s. 4d. Sterling, &c,

The above observations and statements from Mr Hamilton's Essay, are introduced in order to throw light on the trade in wool in general, and to show, what an object it must be to this kingdom to rear fine wool, and to be able to staple and work up the growth of the country; or, at least, how desirable it would be to share in the benefits which result from these great objects,

A laudable degree of caution ought to occupy the mind of the sheep farmer, both with respect to the stock that he rears, and the market where he disposes of the produce. In the west Border districts, it is found by experience that the Cheviot stocks must not be kept 'too fine,' otherwise the sheep are delicate, and suffer great losses. It also appears, that whatever size of carcase be introduced into any sheep walk, there is a certain proportion which it can sustain; and to this

proportion the stock will be gradually assimilated. On pastures, not rich nor ample, the new Leicester breed proves inferior, and unprofitable ; on grounds entirely destitute of shelter, and cold and stormy, the Cheviot breed is hazardous in the time of lambing : All this is known by experience.

But in speaking of the Cheviot stocks, and observing that they must not be kept ‘ too fine ’ for the sheep walks, it ought to be observed, that the words ‘ too fine ’ are used in a sense rather equivocal, implying rather, too naked when young, and too delicate a breed, than one that bears wool of very fine quality. The wool of the new Leicester breed is not so fine as that of Cheviot sheep ; and yet it is known, that the sheep which have too much of the new Leicester in them, are more delicate than the Cheviot breed uncrossed.

The same author above quoted, the Reverend G. J. Hamilton, observes as follows, in his Essay 1808, viz.

‘ Dr Anderson has proved, from indisputable records, that from the earliest times down to the reign of Queen Elizabeth, the wool of Great Britain was not only superior to that of Spain, but was esteemed the finest in the universe ; and he justly attributes our loss of this distinguished preeminence to a system of legislation adopted soon after the days of James the First, and of Charles the Second, by which the exportation of wool was prohibited, under the severest

' penalties. This check, observes this clear sighted examiner, has driven the wool grower from his former attention to the quality of the fleece, to that of the value of the carcase. The following facts, communicated in Dr Parry's second Address to the Bath Society, in the compressed form of propositions, and the result of his own experience, are highly deserving of attention, viz. 4th, From mixed rams, of the Merino crossed with the Ryeland breed, sheep may be obtained, having wool at least equal in fineness to the best that can be procured from Spain,

' 5th, The proportion of fine wool in the fleeces of this cross breed is equal, if not superior, to that of the best Spanish piles, &c.

' These sheep, as described by this intelligent breeder, are entirely enveloped in wool, which grows under the jaws, down the forehead to the eyes, under the belly, and down the legs to the feet. It is astonishing how thickly it covers the skin. It will scarcely give way even to pressure from the hand, and yields as it were by starts, like the close short hair of an extremely fine clothes brush ; and the fleece is heavier in proportion to the carcase, than that of any other known breed in Europe.

' Dr Parry, from a ram of 70½ lib. living weight, obtained, in the year 1797, 8 lib. 2 oz. of raw wool, &c. He has also shown, not only that wool equal, if not superior to that of Spain, has

' been obtained in various climates, but also that
' the nature of the food makes no obvious differ-
' ence in the fineness of the fleece. The experi-
' ments of MM. Lasteyrée and Chanorier in
' France, also produced a similar result,' &c.

Whether these observations and experiments be supported by later information, since the public were more fully and generally acquainted with the pile and breed of Spain, is not the question here. It would be rash and imprudent to pre-judge a point which is now fully under the public view, and must be decided by an extended mass of experience. But it ought to be considered, that if the wool of England was, at one time, the finest known, there may be reason to expect that superior wool may still be produced, notwithstanding the altered circumstances of the sheep walks, and management of the stocks, in England and in Spain, since the time of Charles the Second.

If it be true, that an altered system of legislation has reduced the quality of English wool, yet that system has been undoubtedly of service in compelling, from necessity, a superior degree of attention to the manufacture of wool; which has introduced stapling, and many advantages to a greater extent, into the kingdom. And now that stapling and manufactures are unrivalled in Great Britain, our object ought to be, to attend also to the culture of fine wool, in order to prevent the drain of specie for this valuable article to another

nation, and to remove a dependence which does not appear to be founded in necessity, nor in nature, but in local circumstances and habits.

Mr James Inglis, in his Essay, observes, ‘That great improvements may be made on the Highland wool, is evident. It is acknowledged, that the wool of Shetland is the finest produced in Scotland: on the other hand, Spanish wool is allowed to be the finest of any on the continent of Europe; perhaps in the world. From these two established facts it appears, that climate is not altogether the cause why one kind of wool is finer than another. The breed of sheep, and the nature of the pasture, are as much to be attended to, as climate. From Arthur Young’s Annals of Agriculture it appears, that the soil and nature of the pasture in the Shetland and Highland hills, bear a strong resemblance to those on the Spanish mountains of Segovia and the Pyrenees. That low and wet soils naturally produce coarse woolled sheep, or have a tendency to do so, is abundantly evident, when we look at those large flocks on the fens in Lincolnshire, and on the Kentish coast, from the Thames almost to Dover. Their wool is deep and coarse; and although the breed be changed, they soon degenerate, at least their wool does so,’ &c.

What effects the quality of the soil, climate, and pasture, have upon wool, or what effects the quantity of food and the management of the

sheep may have in altering the pile, either in weight or fineness, are points which have not yet been precisely ascertained, by an experience so extensive as to be fully depended on: but they are likely to be soon and accurately known. And in the mean time, the facts and observations above mentioned, are illustrative of the present situation and prospects of this country with respect to this valuable article of its produce.

It was the policy of Scotland, as far back as the year 1581, that no wool should be carried out of the kingdom under heavy penalties; not even into England, though trading at that time with Scotland, and beginning to be considered as a friendly power. And a similar and more defined policy appears in the act 1661, for encouraging woollen manufactures in this ancient kingdom, forbidding wool to be exported from the same, ‘till made into work, or put to the best avail, for the good of the kingdom;’ and allowing free exportation of woollen cloths and manufactured articles of every description. The avowed objects of the legislature were ‘to keep in the country great sums of money, which were daily exported for things and commodities that might be made at home;’ and to encourage the making of woollen goods, that they might be exported, and money brought in for them from abroad; and ‘to set poor people and idle persons and vagabonds to useful work, for promoting virtue and restraining vice,’ &c.

When this latter statute was framed, it is obvious, from the style of it, that, in many respects, there was great need for it. England herself was, at one period, equally needful of wise laws for encouraging the manufacture of her wool at home. England has now fully attained all the objects intended for Scotland under the above statutes: But Scotland has yet to make a strong effort for obtaining a share in the honour and advantages of that enlightened system. And it deserves the attention of the United Kingdom, how far it is possible to produce at home, the whole of the raw materials necessary for our woollen manufactures; or, at least, to produce them in such quantity and perfection, as may reduce the immense national expenditure and exorbitant prices hitherto paid for the wool of Spain. For it cannot escape notice, that 5s. per lib. for the wool of that country, and 10s. per stone for the great mass of Scottish wool, are prices by far too disproportioned, and highly injurious to our farmers and landholders at home.

Mr Beattie, in his Essay, observes, "that by establishing in Scotland the stapling and manufacture of wool, on a scale proportioned to the quantity of raw material produced in it, the value of wool would soon become as great there as it is in England; that the value of pasture and arable lands would improve at the same time, the stock farmer breeding sheep, and the arable farmer fattening them for him; that an increase

'in the quantity of turnips would follow, succeeded by oats, barley, or spring wheat; and that lasting advantages would accrue to the population, industry, opulence, and comfort of the kingdom at large.' These observations, which are given in substance, are undoubtedly just, and pertinent.*

* It appears now to be an established fact, that flocks may be reared in England of the Spanish breed, producing wool nearly, or quite as fine, as that of Spain; and it is quite certain, that such wool, bred at home, can be more correctly assorted and scoured for the use of the manufacturer, than the wool of Spain commonly is, when imported into this country. Experience on a smaller scale seems to warrant the same conclusions as to the wool of Spanish flocks naturalized in Scotland; but here there is no stapler to discriminate, and no sure market for this fine wool. Of course, few or no farmers raise any of it for the Scottish markets.

PART THIRD.

ON THE BEST MODE OF INTRODUCING THE STAPLING OF WOOL INTO SCOTLAND.

IT would be rash and imprudent to recommend any sudden and great alteration of the channel of trade. Whatever new measure is to be introduced ought to be gradually brought forward. A new channel of trade for wool may be opened, without shutting the old. The one may serve to regulate the other, without obstructing it; and the trade will, in this natural way, be at last thoroughly understood, and find its proper level.

As any new plan, having for its object to staple the wool of Scotland, in the country that produced it, may be supposed to meet with opposition from the wool staplers of England, who are in possession of the trade, it appears requisite, either to conciliate these traders, or to render their opposition fruitless.

With a view to conciliate the staplers of England, let the trade be continued with them ; and let the new plan of stapling a portion of wool in Scotland be contrived, so as not to interrupt or discourage this trade, but only to regulate it, and bring it to a fair level.

Publicity is one great sanction of equity in most commercial transactions. The Fort-William June fair has been, with great advantage to the west Highlands, turned into a market for wool. The newly arranged fairs of Beauly and Langholm promise to be of service in the north Highlands, and in the Borders; and the late understanding among the wool growers of Inverness-shire, by which they seem to engage that their wool shall be inspected before they sell it, is honourable at once to their attention and sagacity.

But further measures appear to be wanting. An agent who does not examine the wool that he buys, or is not a judge of it, is unfit for that business. Why should not the sheep farmers exhibit fair samples of their wool in fleece, and arrange their markets in such a way as to have these markets in succession in different places, and to sell their wool by sample, in public market?

This plan might not be relished by those wool-staplers who at present engross the trade ; but as it carries common sense and fairness on the face of it, their opposition would ultimately be fruitless or ineffectual ; and other men would be induced to come forward and purchase, who are

detarded at present from attempting it; the several clips being in the way of falling into particular hands, who are the only persons acquainted with their relative values; and the mode of purchase being tedious and circuitous, while the labour of establishing a general acquaintance is a formidable obstacle.

By the sale of wool in sample to the staplers themselves who are competent judges, and could attend a series of public markets, the jealous fears of the purchasers respecting the quality and purity of it, would be at once done away; and it would put an end to that slovenliness and imposition with which some individual farmers are charged; and by which all the storemasters are sufferers; while the general regulation of price, according to quality and purity, and settled in open market, would invite attention on all hands.

To prevent all disputes, a clerk of the market should be employed, to give and retain sealed samples, properly marked and attested, and to register the sales and prices; and by reference to his books, and to the samples in his hands, every transaction might be rendered quite clear; while the prices, being open to all, any thing like mystery or deceit would be prevented.

But the chief source of improvement in the wool markets of Scotland seems to consist in the introduction of stapling, in a correct way, and to a proper extent. This might be accomplished, either by encouraging respectable wool sta-

pliers of capital, and accustomed to buy and sell wool, to settle in the country; or by employing practical men who have wrought in the business of assorting wool, and by allowing them wages.

A respectable wool stapler and merchant residing in this country, and conducting business in it, would soon be able to distinguish among the different clips of wool, and to do comparative justice to the growers; and his operations would tend to inform those concerned more correctly respecting the value of their wool, and the proper assortment and purposes of it.

The sale of wool in a stapled form, by retail, (which ought to be stipulated), might also encourage the home manufacture. But still, as (for some time at least) the bulk of the sales of his assorted wool might be into England, it would not perhaps be an ordinary inducement that would prevail on a man, established in business, to quit his residence, and undergo the risk of a new undertaking in a remote place. Neither would that plan be quite free from the danger of his abusing confidence, or becoming a monopolist.

To the plan for employing practical men who have wrought for wages in the assorting of wool, and might be depended on both for skill and integrity, some objections undoubtedly may be made; but they do not seem to be of so much importance as to prevent the most cautious and prudent person from recommending it, for the purpose of a fair trial.

The capital requisite for such a plan, and the charges of conducting it would be mentioned as objections; and perhaps also the hazard of getting proper persons for assorting men duly qualified and sufficiently faithful; or, the danger of not being able to find a good market for the stapled wool.

With respect to the charges and capital, provision would indeed be requisite for setting the stapling business a-going, and also for affording occasional stimulus to it, or leading it into new or better directions; but, if the extra price obtained for stapled wool did not do more than cover the charges, after a fair trial, the plan should be given up. There seems to be little or no reason, to dread this, if the wool, by stapling, becomes more than doubly valuable, as Mr Duncan observes. As to the hazard of getting persons duly qualified for assorting, and sufficiently faithful, in that business, there can be no doubt that, in consideration of superior wages, many operative workmen in the stapling line would be glad to engage. When every new stapler finds hands—what should hinder a respectable agent or broker from engaging some to come down to Scotland? And when once engaged and employed, the interest of the persons for whom he works ought to be made to correspond with his own interest; while, more than one person being engaged—the natural wish to acquire credit—the stimulus of interest also working on their minds, and perhaps

a degree of mutual emulation, together with the eye of their employers on them, altogether ought to secure attention and fidelity. The most formidable objection would seem to consist in the uncertainty or difficulty of finding a good market for assorted wool. But if the operations of the stapler were faithfully and skilfully performed, and the proper places for disposing of it considered, there could be no more danger of selling assorted wool by agents or brokers to the manufacturers in England, than there is danger in selling any other consignment of goods, for which there is a natural and constant demand. There does not appear any greater danger than occurs to the staplers themselves, when they purchase wool by agents in Scotland, in the fleece, and unseen. Indeed, the danger in the latter case appears to be the greater of the two. Give the manufacturers well stapled wool, at a moderate price, with the prospect of a continuance of the trade, and they would naturally do what their interest must dictate—they would buy.

It would be as much their interest to support this plan, as it would be the interest of the land-holders and sheep farmers in Scotland to introduce it. The profits of the staplers would naturally be divided (after the broker was paid for charges and percentage) betwixt the sellers of the wool and the buyers.

It is not easy to define accurately the respec-

tive interests of landholders and sheep farmers in the introduction of this plan. That of the farmers is near, but it is transient; that of the landholders is more remote, but permanent. The latter class are perhaps more fully aware of the importance of such a plan. Whether the sheep farmers, as a body, are equally aware of their interest in this matter, is, at present, rather doubtful. Such of them as possess extensive information and views, would not fail to enter into it, with a proper sense of its importance. Others, fearful of any thing like innovation in what concerns their sales, and perhaps not accustomed to inquire particularly what becomes of their wool, after it has passed into the hands of the merchant, may require time and reflection for enabling them to determine.

But, although a general proposal for introducing the stapling of wool into Scotland, might seem too remote and obscure to be decided on, yet a special plan for doing it, which offers the visible prospect of advantage, without imposing any sort of restraint, or taking one shilling out of the purse, could hardly fail to meet their approbation. Indeed, no liberal minded farmer can be disposed to object to such a measure.

Such a plan it is intended to sketch out in what remains of this paper. Allowance will be made by every candid person for the novelty and imperfections of it. Experience and growing skill must be allowed to improve every plan of a

mixed description like this; partly mechanical, partly commercial, and, in one view, national and political; while it also involves extensive private interests.

The objects requiring most particular consideration, appear to be those which follow, viz. proper stations—operative men for stapling—funds for going on with the plan—the requisite storehouses and apparatus—and the proper mode of sending stapled wool to market.

The stations, it would seem, ought to be contiguous to extensive sheep walks, and to afford the means of carriage or conveyance; and there should be a prospect of hands to employ, and of buildings for accommodation. They ought also to be central, for the benefit of an extensive district; and convenient for the purpose of manufacture, if this grand object could be promoted along with stapling.

Workmen, for the business of stapling, should be engaged by respectable agents or brokers. They should be men well accustomed to assort the wool of Scotland, and especially that of Short sheep, and of the Cheviot breed; and, if necessary also, the long wool of the new Leicester sheep. In order to engage them, certain wages must be offered, and comfortable accommodation; but, with a view to encourage fidelity and zeal, a small percentage on the profits arising from stapling ought also to be allowed them. All their work should be regularly performed

with open doors ; and they ought to be bound down to instruct others in every part of the business. It may also be necessary for these men to attend to the variations of trade and markets ; and to adapt their operations accordingly.

To provide a fund for commencing and carrying on this plan, a subscription of landholders appears necessary, if some public money cannot be obtained for that purpose. It would seem, also, that this fund must be continued for a certain number of years. In aid of it, the farmer should allow a proportion, not of the price of his wool, but of the surplus obtained for it, in consequence of its being stapled at home. In a short period, this last fund ought to supersede the necessity of any other.

Buildings might be hired for a trial, and fitted up into suitable compartments, as in England, with pulleys, weights, beams, packages, baskets, and other necessary implements, with a suitable and strong light over it, for the operative staplers, and convenient places for storing the packs of fleece wool, and the different denominations of stapled wool.

A clerk of the business would be necessary for the purpose of registering and marking all the wool packs delivered in, with the dates of delivery and names of the owners, and for attending during the process of stapling, and marking and registering the sorts and quantities of it after being stapled ; and then for recording the delivery

or sale of the assorted wool, or the shipping and consignment and returns from the broker, agent, or supercargo. His business would also be, to assist the stapler and owners of wool in preparing fair and correct samples for the satisfaction of the seller as well as the purchaser, and to retain under seal corresponding samples, till the wool should be finally disposed of.

The farmers would have it in their power either to employ the stapler or not, as they should see fit. They might put in whatever number of packs they pleased, in order to be stapled; the delivery would be recorded; and the wool duly marked in the packs. Even in that state, samples would be prepared. The farmer might attend during the whole process of stapling his own wool, if he should be inclined. He might sell it out of the stapling house, or take it out, at any time, or in any quantity, he should think proper. Or, he might employ the stapler or clerk to sell it for him, under orders in writing, registered in the books, and subscribed by the parties: and the sale might be in the neighbourhood partly, and partly also to manufacturers or their agents, either from Scotland or England. If no proper opportunity should occur for disposing of it in this way, the stapler and clerk might have orders to make up, under the eye of the proprietors, one cargo after another, at proper intervals of time; and to consign them to some agent or broker in England, or commit them to the care of a super-

cargo, with instructions to sell the wool to the manufacturers. But for the trouble and expense of receiving the wool, storing it, making samples, assorting, selling, and delivering it, the owner should, in all cases, pay a reasonable percentage out of the nett profits or surplus price obtained by means of the stapling house above the current prices of similar wool sold in fleece.

The market for wool in the staplers' rooms ought to be perfectly free to any person who should purchase a single package of stapled wool, and give security for the price in three months; and in order to encourage a full sale, these packages ought not to be too large, and should be sold in any number wanted. This would give encouragement for the home manufacture; and an opening market at home would stimulate the manufacturers of England to send orders. It would be so much and so evidently the interest of the manufacturers in England to meet this plan, and to give it their support, that, if reasonable credit were given them on security, by the broker or agent, there could be little doubt of the sale. And if regular method and despatch were observed, the price would perhaps come sooner into the farmer's pockets, than it does through the hands of the present wool staplers, and with fully as little risk.

In regular order, the wool first sent into the house ought to be first stapled, and would have a chance to return the earliest price. But per-

haps the latter parcels would bring as large a price. In good policy, there ought to be a succession of sales, in order to supply the public regularly at all times.

To ensure attention, and redress complaints, the eye of some gentleman of intelligence and authority ought to be occasionally and frequently on the whole business. He would be enabled to discuss complaints, redress wrongs, and see the funds applied to good purpose ; and he would stimulate and maintain the spirit of the whole institution, under the controul of the subscribers or their committee. In the course of a few years, the stapling house and business ought to support itself on principles purely commercial. The knowledge of this valuable art, and of the proper uses and real value of wool, would be diffused more correctly and extensively ; and various improvements might be expected to occur in the plan of conducting the business, till it should settle, at last, into a form resembling that which obtains in England.

For an operative stapler, perhaps a salary of 80*l.* a year for a certain length of time certain, ought to be tried, and the benefit of a neat small house to reside in ; and in addition to this encouragement, a percentage on the nett profits arising from stapled wool, after all charges, should be deducted, say 5 per cent. ; and 5*l.* a year extra for every young man that he should instruct fully in the business, to the satisfaction of the superintending committee.

It is probable that, for a sum not much exceeding 50*l.*, a stapling house and accommodating stores might be rented for a given number of years; and that, for the sum of 200*l.* or thereby, the buildings and implements might be fitted up, on a small scale, for a safe experiment.

A clerk of the stores might probably be engaged, in any part of Scotland, for a free house and 50*l.* a-year of salary; some additional allowance being provided out of the surplus arising from stapling, which would be in proportion to the quantity of work performed, and the success of the operations.

These are merely hypothetical calculations; and no person can so far misunderstand them as to suppose, that they are meant for any thing else than a simple trial of stapling alone. Capital for the purchase of wool, and of machinery for manufacturing it, are out of the question. The first object would be, the market at home for families or manufacturers. If the business were to succeed, it would be easy to extend and improve it. In any event, the manufacturers in England would be an ultimate resource, if the wool were well assorted.

An outlay of two or three hundred pounds, for fitting up hired buildings, and finding implements for one stapler, with an annual expenditure of two or three hundred pounds in salaries and rents, would seem to form an insignificant fund, compared with the capital supposed to be

requisite for commencing in Scotland, by a gentleman at Leeds. But this correspondent, in quoting the capital of Messrs Wormald, Gott and Wormald of Leeds, at £500,000, may safely be understood as giving a statement of one of the largest capitals employed there, for the purchase of wool, as well as the stapling and manufacture of it ; and it is the purchase of large quantities, and the machinery and expenses of manufacturing, with the long outlay, that require the large capital. The simple process of stapling, resembles that which is carried on in the teasing and carding mills (now very common in Scotland) in one respect ; that is, it is conducted without much capital, and applied to the wool belonging to other people, in order to prepare it better for market and for use. When the stapling business has been got into a successful train, those concerned may then find time to consider of conjoining stapling with manufactures, and of investing capital, on a larger scale. In the mean time, if the simple plan for introducing practical stapling were tried, in various places, at once, it would multiply the charges in proportion to the number of places.

When the business of stapling shall be carried into Scotland, on a scale resembling that of the great staplers in England, who purchase wool, staple it, and then manufacture it ; the management of such an undertaking would indeed require capital, and ought (probably) never to be

- undertaken by such a body as the Highland Society; but by a company of merchants or people of experience, on a plan, similar (perhaps) to that which has been mentioned to the Secretary, by a gentleman in Edinburgh, who not only suggests, but offers to assist and embark in it himself.

But though a large company should actually be established for assorting and manufacturing wool in Scotland, the objects of the Society would not be attained, unless there were opened a free market for stapled wool, in order to accommodate the public.

The observations of a gentleman near Leeds, dated 23d February last, and directed to the real object of the Society, are very sensible and encouraging. He observes,

' If you only wish my opinion on the wool-stapling business, without the manufacturing business, I think there is considerably more chance of its answering; though I think it would be a long time before you would begin to find the benefit of it from this country. But if you could find a market in Scotland for the different sorts which are stapled out of the fleece, I think it would answer very well, there being no people that staples wool in your part of the country that I know of. If so, you would have no competition; and the parties who use the wool stapled would find it their interest to buy it stapled, rather than buy it in the fleece off the

'farms, for several reasons. They could always buy the sort they wanted ; and when they wanted it, it would be properly stapled, and make a more even piece of cloth. I have no hesitation in saying, that I could find you several men who would be willing to come to Scotland,' &c.

Now this is just the object in view. The Society wish to introduce the stapling business, in the pleasing hope that manufactures will be thereby promoted. It may be in their power to accomplish the one : as to the other, that of manufacturing—it must be left, probably, to families or companies to undertake it.

When, in Scotland, the few manufacturers that reside can afford, without stapling, or by the rude and inaccurate assortment which they can make, to work up woollen goods for the market, how much more profitably might they do this, if their materials were all well assorted, and each portion applied to its own natural purpose ?

The advantages of such a plan are many. One of these would be, that besides assorting, the wool might also be scoured in Scotland. This operation would reduce the weight almost to one half ; and in the same proportion the value would be augmented per stone. The saving of carriage would then be great ; and the article, after being assorted and scoured, would be just ready for the hand of any that should wish to manufacture it.

That England possesseth many advantages over Scotland, is more evident in the manufacture

of wool than in any other. The iron foundry of Carron, and the various cotton works in Scotland, are proofs of the spirit and industry of the people. And the superiority of England in respect of woollen manufactures, diminishes yearly, as the quantity, variety, and quality of wool, improve in Scotland. To aim at becoming the rival of England is not necessary : It is enough to imitate the wise policy of that flourishing country.

A prudent undertaking, on a moderate and safe scale, could hardly do any harm, and would probably lead to great advantages. The stapling of only two or three hundred packs of wool, of the Cheviot or finer sorts, ought, according to a very moderate and low estimate, to raise the value at least one third. Say that wool sampled in the fleece, and valued at 30s. per stone, could be raised to 40s. per stone after assorting ;—the surplus, at 10s. per stone, comes to 6*l.* per pack ; and on 100 packs, to no less than 600*l.* One half, or even one third of that surplus, would go a considerable way towards defraying the charges of stapling ; and the remaining part of the surplus would go to the wool-grower, and encourage him to rear fine wool, and to send it to the stapling house in future years.

Whatever nett profits can be obtained for wool properly stapled, must have the important effect of raising the price of wool sold in the fleece. Monopoly and combination, if such things exist, must be checked ; while the fair value of wool in

any form, and of all descriptions, must become known. The new stream of trade that would open in the stapling houses, with the prospect of increasing, would enable the farmer to come easily at his price to the full extent, and the manufacturer at his materials, in a proper and useful form. The relative purity and quality of each clip would soon be correctly understood; while slovenliness and imposition would be detected and prevented. The attentive farmer would find his reward under such a system; and even the staplers of England would find benefit from it, in a superior degree of purity in their cargoes of wool from Scotland. Nor is this all, or even the most important view of the benefits that would be derived. For, on the opening of a free market in retail for stapled wool, at a moderate price, it would be an insult to the good sense and spirit of the country, to doubt that manufactures would be extended where they exist, and opened where there are none. And though the profits of the present wool-staplers might be abridged, their losses would in some degree be prevented, by means of greater attention on the part of the wool-growers; and their profits could not fall below their proper and legitimate level.

What influence the stapling business may have in improving the pile of our Scottish wools, must be left to future experience. Our farmers enjoy the means, both of introducing the best breeds of England, and of supporting them on improved

herbage and keep, summer and winter. We have now also the full benefit of numerous Cheviot stocks ; and access to the pure blood of the Merino sheep of Spain, including the Negrette race imported in 1791, and the Paulars, imported about two years ago. The experience of the Swedish sheep farmers since the year 1723, when a merchant of that country imported into it a flock from Spain, and that of the Saxons, since 1766, are sufficiently encouraging ; for the wool obtained a few years ago by the way of Hamburgh, was found to answer for the wool of Spain, though it came from Germany, and consisted of the fleeces of sheep long naturalized there. To preserve the finest piles, it is indispensable to guard against contamination by crosses ; and for this end, the discrimination of quality, and the corresponding price, ought at once to prove an inducement and a recompense. It would be improper to quote those immense and extravagant prices which have been lately given on speculation, and from the apprehended danger of a cessation of our supplies from Spain ; but while the fleeces of Merino sheep, bred in this kingdom, are sold from the backs of the sheep at such prices as may be supposed to reach about 4s. 6d. or 5s. per pound, on a fair average of years, we need nothing more to show how important it must be for the British farmer to attend to the pile of his wool, and to landholders and public bodies to give their countenance and aid for his encouragement and reward.

That even this important object (now more important than ever) must not occupy the whole attention, to the neglect of carcase, our farmers are quite aware. And that much of the success of all sheep farming depends on the proper selection of the breed, and on the most proper use of the natural and artificial produce of the farm, for the purpose of giving health and vigour to the stocks, are obvious truths. But the farmer ought to have the credit both of skill and spirit, who is able to reduce these principles correctly into practice; to select the most suitable carcase betwixt the heaviest and lightest, and the most productive fleece, betwixt 10s. and 80s. per stone; and to rear and sell to most advantage.

To aid him effectually in this last part of his business, (without which no other part can be successful, or meet its reward), the value of wool, and purposes for which it is adapted, cannot be too well known; and every inducement ought to be held out in the markets for wool, and by stapling and manufacturing it, that has a tendency to reward the man who rears the best, the largest, and the purest fleece.

Kirkpatrick-Juxta, 1811.

OCTOBER 1811.

ESSAY

ON THE

VARIETIES OF WHEAT, BARLEY, OATS, PEAS, AND BEANS ;
AND ON THE DISTINGUISHING PROPERTIES BY
WHICH THEY ARE ADAPTED FOR CULTURE
IN DIFFERENT SOILS, PLACES, AND
CLIMATES.

By the Rev. WILLIAM SINGERS, D. D.

IT is a striking fact, that of all these kinds of grain, so valuable and so generally cultivated in Britain, there is not one kind or one variety that was indigenous ! The wild oat, or haver, *avena fatua*, was cultivated in various parts of Scotland. The sea pea, *pisum maritimum*, has never been in culture ; and for every other variety of all the above mentioned kinds of grain, we are indebted to foreign countries and enlightened cultivation. The *vicia sativa*, common vetch, is a native plant, and is now in culture ; but it is not connected with any of the above genera.

Within less than fifty years, it was not believ-

ed that white oats would grow at all, where none else are now to be seen! Bear was thought to be incapable of growing in lands which are now under fine crops of barley and wheat! The value of *early* varieties of oats was not understood, in many high situated and late districts, till the severe losses in the bad harvests of 1782 and 1799, induced the farmers to seek after suitable species of the oat: and since these were introduced, the grain, even in high districts, is for the most part well ripened, and productive in meal.

The introduction of the Lime and the Drill husbandry, with turnips and sown grasses—clover in particular;—the discovery and liberal culture of potatoes,—the improved rotations of crops introduced,—and the numerous and valuable species and varieties of the different sorts of grain,—have, altogether, made astonishing changes in the whole system of agriculture.

Rotations of crops are now very properly studied by farmers, in so far as relates to the *kinds* of grain and green crops. A correct understanding of the several *species* and *varieties* of these kinds of grain is also an object of great importance.

Not only does one species or variety prosper, while another fails; but accidents highly detrimental to the crop are common to one, while another is mostly free from them; and particular sorts answer best in the intended course, to follow one crop and go before another. At the

same time, each of them has a certain range and description of climate and soil, in which they either more or less prosper, or fail.

Science now furnishes a strong and attractive light in pursuing these important investigations. Immense progress has been made, even by individuals,* in this noble field. While Nature clothes with productions, richly diversified, the vast plains and elevated ridges of the Equatorial regions, and yet preserves, with remarkable uniformity, a range of elevation suitable to these respective productions; we are taught by Nature, not to overlook the connexion that exists between plants and climate; and cannot suppress the admiration which is excited by the useful and magnificent lessons thus communicated.

Practical skill, exerted in combination with exact observation, is necessary, in order to profit by these lessons, and to render them subservient to the good of the kingdom. The field that here opens, like the savannahs of the new world, appears interminable! It is rich also in the prospects of more valuable fruits than have been yielded to other nations, from the most celebrated *mines* of that vast continent. In latter times, the noble spirit of agriculture and commerce that has flourished in Britain, under a liberal and free constitution, has led to the possession of wealth, comfort, and power;—such as the

* Humboldt, &c.

soil of Spain, together with its *climate*, and *gold* and *silver*, have not been able to secure !

We may receive instruction (and permit the salutary influence of a stimulus towards improvement) even from a hostile nation. France begins, in her own soil, and with partial success, the culture of those plants which her colonies formerly afforded her. The fruits of our East Indian possessions are under trial in the soils and climate of the West. These are efforts deserving of attention. *

In Great Britain, the gardens, orchards, and hot-houses, are now bearing the plants and fruits of almost every climate and soil ; and the fields are every where covered with the corn and vegetables which have been introduced from foreign lands. The improvement already attained is immense ; but there can be no reason for supposing that great and important improvements may not still be made.

In the proper selection and culture, even of indigenous plants, * the present time appears to promise much advantage. But, so important an object has it now become, to raise within the island *corn* for its own supplies ; and so interesting must it be to the landholders and farmers, to adapt the species and varieties of all the kinds of cultivated grain, to the proper soils, climate and

* Florin, Turnery, Holcus, Linum, Cockle, and various

situation,—that few disquisitions in agriculture can be more seasonable.

Nature seems occasionally to multiply *varieties*, by the intermixture of *species* during the flowering process; while the qualities are modified or affected by soil, climate, and culture. No correct botanical descriptions of these varieties in corn exist; and the names affixed by farmers are variable and arbitrary. For these reasons, observations and communications must be frequently made. A farmer selects a fine plant of wheat, and preserves the produce of it; * another makes a similar selection of a variety of oats; † and a third selects a particularly fine plant of rye-grass.‡ Thus may a whole kingdom be laid under obligations, by the judgment and attention of a few individuals.

From time to time, an account of the best varieties and species in culture ought to be made out. Former statements of this nature must be useful and interesting; but the true way to prepare them, is to survey the fields, to collect the accounts of respectable authors, and to bring down the statements to the times when they are drawn up.

Neither a correct botanical description of the species and varieties of corn, nor the common and variable names by which they are known to farmers, can exactly answer the views and intentions

* Hunter.

† Church.

‡ Peacy.

of such works as these ; but such an account of the species and varieties may render them capable of being known and selected, and may also be connected with a view of the situation, climate, and soil, in which they respectively thrive, or in which they are liable to fail. And as plants may fail either from a defect or fault in the soil, or from distemper, or accidental injury, the dangers arising from all these ought to be taken into account.

It may also be observed, that farmers look with jealousy on those experiments which are made in small select spots of ground. They may be useful, indeed, in many respects ; but field culture, in order to proceed on a trusty basis, must be sanctioned by experience taken from the fields.

Ample room will always be left for additional information. Time will unfold new observations as to the grain which is now in culture. Possibly new genera may be introduced ; and it is highly probable that new species, and improved varieties, will come to be known. It is obvious, therefore, that in all such works as these, the author's views must be, in some degree, local and temporary, and in the same degree imperfect.

ESSAY

ON THE

SELECTION AND CULTURE OF GRAIN.

PART FIRST.

WHEAT.

THIS golden grain, as it has been called by eminent farmers and authors,* we owe to warmer climates, and to the spirit and industry by which it has been cultivated in this island. The demand and consumpt increase yearly; and as the markets are fully more favourable, in general, to wheat, than to other kinds of corn, it is very natural for the farmer to wish to introduce it in his clean and rich lands. Yet it is evident, that to push the culture of this grain too far, by sowing it in lands not suitable, or in places and climates hostile to wheat, must be attended with heavy loss to the farmer and to the public.

* Young, Brown, &c.

Judicious and spirited cultivation, and a correct and discriminating eye to select suitable species and varieties of seed, have a great effect in extending the range of wheat-bearing soils. The most natural and suitable fields are such as consist of strong soils. A heavy rich *loam* is, perhaps, the best of any; but *carse* lands, and well worked and manured *clay* soils, are also very suitable. In light soils, wheat may produce a moderate crop when the season favours; but soft soils are unfit for this grain. *

Poverty in any crop may be considered as a sort of disease; and, very commonly, it induces distempers. To *drain* (if necessary) and to *manure* lands intended for wheat; and to *pulverize* properly, destroying *weeds* and *insects*, are necessary operations. These, on lands formerly in culture, would require autumnal or *winter tillage* on the stubble; and a well worked *summer fallow*, either plain or green, to follow. † Then comes the due selection of *seed*, and the seasonable and correct *depositing* of it in the soil. After all, the season may not come to be propitious: But the farmer has done what was in his power.

As to *situation*, it may in general be observed, that wheat should not be attempted in climates too cold and exposed for its living and ripening; neither does it prosper well in situations extreme-

* Brown on Rural Affairs.

† Light soils, after plain fallow, are in some danger of throwing out the seed in the following spring,

ly close and confined ; being apt to suffer severely by mildew, and want of sun and air. Betwixt these extremes, there is a considerable range of soil and climate which may answer wheat. The heat of this island is, in general, rather too low for this grain ; and the strongest and richest soils produce it in greatest perfection. Sea air and winds are found by experience to be salubrious ; and, for these reasons, the maritime districts are particularly suitable to the culture of wheat. Enclosures are of advantage to it, in various respects, if they be not too small and close. But, if the fields be not so much exposed as to hurt the crops by chilling winds, or violent gales, or frosts too early and intense, they are the better for open sun light, and free air and ventilation. Prejudice had banished wheat from the western coast, as too moist for its culture ; but this error has been in a great degree discovered and rectified.

These *general views* relative to the culture of wheat are not founded in particular experiments, the result of which is, in most cases, dubious ; but in general observations, and in the common experience of wheat farmers.

Limited, then, as the natural range of soils and climates producing wheat spontaneously, undoubtedly is, it is pleasant to reflect how widely that range is extended by cultivation. Wheat is raised about the 60th degree of latitude in the north of Europe ; and the culture of it extends,

in proper elevations, to the Equator! Here, at an elevation extending from six to nine thousand feet, the culture of wheat prospers; and it begins to form an ear at the height of 4500 feet, and ripens its grain as high as 10,800 feet above the sea level. * It is very true, that in low situated, Equatorial, or even Tropical regions, the heat is too great for this valuable grain; and that the climate of the northern parts of Britain is less propitious to it than that of the southern parts. But, still, the range of its growth, in favourable culture, and in suitable soils and situations, is very extensive. Sparing, as Nature spontaneously seems to be, she is liberal in rewarding the prudent efforts of industry and skill.

It may tend to promote the objects of this paper to mention, in a list, the most common distempers and accidental injuries to which the wheat crops in general are liable; and afterwards the species of this kind of grain in culture in Britain, with their subspecies or varieties, and such characters or notes concerning them as may appear to be connected with their culture.

The distempers and accidents by which the wheat crops are liable to be injured, are more nu-

* Humboldt's Tableau Physique, &c.

merous than occur in any other kind of grain. They may be simply mentioned as follows, viz. mildew and rust; blights from different causes; abortion; laying down, and crushing; throwing out by spring-frosts, and sun; root-falling; smut; late ripening.

Mildew or rust, the spotted distemper in the straw and ear, *rubigo*, is of various colours; yellow, brown, or black. The brown is most common and fatal in Britain. After a crop has been struck with mildew, it becomes no better, but worse every day; and must be cut immediately.* The mildew is either general, or local. The former, brought on by the particular season, is hurtful to all sorts and varieties of wheat, but less to some varieties than to others; and in particular situations, and after particular sorts of manure, it is also considered less destructive. The local mildew hangs over particular places, and is considered as being induced by such plants as harbour the parasitical fungi which occasion mildew, by disseminating their light microscopic seeds, and thus propagating, over a certain space, this pernicious malady. At the head of these plants is the Barberry.

*Blight*s are here understood as the distempers that accompany a pale, emaciated appearance in the corn, from whatever causes it may proceed—such as, frost-mists followed by sunshine, wet and poor soils, imperfect culture, &c.

* Young's Farmer's Calendar.

Abortion is mostly occasioned by severe wind and rain hurting the anthers when the wheat is in flower, and carrying off the fine dust or pollen which these anthers contain. If this take place, abortion follows of course. It may happen, that, by this cause, a few cups may be left without any grain to fill them ; or the one side of the ear (or, in the very worst cases, the whole) may be empty.

Wheat that is only partially *laid* to one side, is thereby injured ; but if it be *laid down flat*, the stalks *crushed*, and the ears deprived of open air and sun light, the damage is great : And if the lodged grain *sprout*, or if the stalks that are broken down become entirely incapable of transmitting the juices of the plant, and *suckers* appear, then the loss must be very considerable. When the soil happens to be too rich, and the field small and close, this loss is aggravated.

Spring-frosts are most ready to do mischief in soft, blistering soils, and, next to these, in soils of too light a texture. It is better to sow rather early in October, or even in the latter end of September, and under furrow, in order to prevent this misfortune; rolling the lands to give solidity. By these means, the seminal roots are enabled to take a deeper hold, and the coronal roots materially assist in keeping it.

Root-fallen wheat is most commonly seen in soils that have little depth and solidity, and are also too much exposed to every blast of wind.

If the grain plant shallow, and the ploughing be not sufficiently deep, this evil is likely to happen. The drill-culture, by earthing up the plants, contributes mechanically to prevent it.

Smut is a distemper communicated in the seed, and is prevented by attentive selection of the fairest samples; or by the use of old wheat, properly cleaned and washed for seed; or by washing and scumming new wheat, and then pickling and dusting with lime, and afterwards immediately sowing. *Late ripening* is a serious disadvantage to a crop of wheat, and particularly in a high latitude or cold situation. On this account, it is recommended to sow potato oats, in such circumstances, as the first crop after plain fallow with dung and *lime*, in the county of Caithness; introducing wheat, after some crops have been obtained, and the lime has in part ceased to protract the ripening process.—(See *Farmer's Magazine*, Nov. 1807.

The species of wheat cultivated in Britain are two, viz. *Lammas* wheat, *Triticum hybernium*; and what is called *May* wheat, *Triticum aestivum*.

The former is the grain which is cultivated in all the real wheat counties. It is the finest species, and contains many varieties; and the seed of it is put in for the most part in autumn; but after turnips, it is often sown early in spring.

The latter is a coarse wheat, very seldom cultivated; but when it happens to be sown at all, it is generally put into the ground in the latter end of April.

A degree of confusion attends the names by which these different species of wheat are known; and it so happens, that, in this island, neither the one name nor the other is generally suitable. The wheat counties of the south of England may readily understand *Lammas wheat*; because their general crops are in readiness for the sickle at that season; yet the other species of wheat, if sown at all, may probably be ripe about the same time; so that Lammas wheat is not a distinctive name. Being mostly sown in autumn, and reaped in the same season, it is conceived that '*Autumnal wheat*' is the proper name, instead of Lammas wheat, or *Triticum hybernium*, neither of which are appropriate, at least, in this island. As to the other and coarser species called *May wheat*, or *Triticum aestivum*, it may, in some rare instances, be sown in May; but the latter days of April are its best and most common seed time; and it would be as well known by a name quite appropriate to it, '*April wheat*.' The April wheat sown in Britain is either wholly, or almost wholly, dark in the colour, thick in the husk, and having a long beard obvious at a distance, the finer wheats having awns greatly shorter.

It is more necessary to attend to proper distinctions, because the wheat farmers of the Lothians

and Berwickshire call that part of their fine wheat (of the Lammas or Autumnal kind, *Triticum hybernum*) which happens to be sown last, in February or early in March, by the name of ‘*Spring wheat*;’ and the same name has been given by many of the most eminent patrons* of the coarser species (the *Triticum aestivum*) to this latter and very different sort of grain, which it is here proposed to call ‘*April wheat*.’

The finer species of wheat, and all the subspecies or varieties of it which are or may be sown in autumn, are therefore to be called in this paper, for the sake of distinction, by the general name of ‘*Autumnal wheat*;’ and the coarse, dark, and bearded species, answering to the *Triticum aestivum*, is to be called ‘*April wheat*.’

The natural distinctions betwixt these two species, in so far as the farmer is concerned, are to be taken from the following particulars, viz. that autumnal wheat is by far the finest grain, and yields the finest meal; that it answers better to be sown in autumn than in any other season; and that it suits the real wheat soils and counties far better than the other species.† On the other hand, this April wheat, of a dark hue and coarse aspect, may be sown in the wane of April, with

* Sir John Sinclair and others.

† Young’s Farmer’s Calendar.

advantage, in soils too coarse for Autumnal wheats.*

In cold, thin soils, properly dressed, but not suitable for barley, April wheat answers better, and returns more than either barley or Autumnal wheat. It is also a matter of importance to possess the resource of a crop of this wheat, in case the season has been such as to obstruct the sowing of Autumnal wheat as far as the middle of March; for then it will be much better to dress the lands well, and sow April wheat in the want of that month. †

But in rich and early barley soils, this coarse wheat seldom answers; and, indeed, in these it cannot be necessary to sow it. ‡

With respect to distempers, it has been remarked, in seasons of mildew, that heads of April wheat, growing as weeds in Autumnal wheat, were equally affected with that distemper.

The result of all is this.—In the real wheat climates and soils, Autumnal wheat is greatly preferable; in light soils (dry and early), barley is most proper; but in lands fit for wheat in respect of soil, only too late to be sown with safety, and in colder and coarser soils than suit autumnal grain, April wheat may be sown in preference. Of course, it may be sown also at a greater elevation.

* Marshall.

† At Mount-Annan in Dumfries-shire.

‡ At Hillside near Lockerbie, Dumfries-shire, it has not answered at all.

Autumnal Wheat, or, as it is called in England, Lammas wheat, and by botanical writers, *triticum hybernum*, has been arranged into different subspecies or varieties. The most obvious distinctions have been taken from the colour; or from the glumes (chaff)—or from the form of the ear—or from the stoles at the root. But all, or most of the varieties of Autumnal wheat, may be arranged under the *red* or the *white*.

Of the *red wheats*, there are two varieties, both of them valuable. The one is called in the south of England *red Lammas wheat*; the straw, kernel, and ear being all red, and the flour fine and white. This variety is preferred by many farmers to any other description of wheat known; but in Scotland, it is not so well liked in the market as white grain.

The other is called *creeping wheat*, on account of its property of sending out many stoles, and was introduced from Yorkshire into Northumberland, and thence into Berwickshire. In Yorkshire it was cultivated with success on sandy soils. In 1808 it resisted, very perceptibly, the severe mildew of that season. It resists early frosts, and remains in the soil when other sorts of wheat are thrown out; and it makes a more ample return than other autumnal wheats, on poor soils. It is rather a coarse variety of the red wheats; but on thin soils, many farmers in the real wheat coun-

† Young's Farmer's Calendar.

ties prefer it before any other ; and some of them sow none else, either in autumn or in spring. *

Of the *white* sorts of wheat, farmers have made out two subdivisions, viz. thick-chaffed, and thin-chaffed: The former were formerly preferred in the Lothians, as being supposed to yield the finest and whitest flour ; and in dry seasons, as much grain also as any other: In 1799, these thick-chaffed wheats were found to suffer more by the wet and unpropitious harvest ; and they also suffered more by mildew in that and subsequent years. For these reasons, the culture of them is mostly given up, in the Lothians and Berwickshire.

Thin-chaffed wheats have been substituted in their place ; thick-chaffed ears appearing among them only as weeds. The most approved variety of thin-chaffed wheats is that which has been selected and cultivated by William Hunter, Esq. of Tynefield, in East-Lothian, at † the Know.

The best subspecies of thin-chaffed wheats are white ; and grain of this colour is preferred for spring sowing, being found to ripen earlier than red wheats in general do. ‡

In the south of England, the farmers, besides the *red Lammas* and *coarse April*, already mentioned, are accustomed to distinguish other va-

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* Kerr's Survey of Berwickshire.

† Brown on Rural Affairs.

‡ Kerr's Survey

ieties. *Hoary white*; the straw, ear, and grain, white. *Clark wheat*; red blossom, chaff, and straw, but white grain—a favourite in Sussex. *Hedge wheat*; very productive, and of a white colour. *Velvet wheat*; a different variety from the hoary white, though of the same colour—thin skin and much flour. And *Cone wheat*, a name borrowed from the conical or tapering form of the ears. ||

The names and varieties of wheat are very numerous; but the names being mostly arbitrary, and therefore variable, and these varieties ill defined, it has been thought better to make out the primary distinction into *species*; and of the chief *species*, to mark the above *subdivisions*, pointing out the most valuable and esteemed *varieties* in each. This is all that can be done, in the present state of things. The most eminent wheat farmers and writers on agriculture are sensible that a correct nomenclature of all the varieties of wheat, with suitable descriptions of each, is yet a desideratum.*

A change, from time to time, seems grateful to the soil; and nature, by the intermixture of the flowers of different sorts and varieties, frequently produces this change. The farmer of observation remarks this, and takes advantage from it. A collection of new facts on the sub-

ject, from time to time, and a short and accurate epitome or digest, would be of great value. At the same time, botanical observations might be made on the most approved varieties, at the time of inflorescence; in order to ascertain and fix their distinguishing characters.

In the mean time, as a basis for such collections of useful facts on the culture of wheat, the public are in possession of the accumulated stores contained in the county reports, and brought down to a late period; with other valuable works, in which the culture of wheat is mentioned, and where some notice is also taken, though not in general very particularly, of the several varieties in cultivation.

Of the genus *triticum*, to which all the wheats belong, and various other plants not bearing grain, there are enumerated, in botanical works, 26 different species, taken from the different quarters of the earth. The species *aestivum* is there set down as an annual plant, very properly; and the species *hybernum* is marked as a biennial. It is evident, however, that this description does not always apply to a plant that may be sown in Ja-

January or February, and even in the first days of March, and ripen the seeds next autumn.

The farmer is obliged to consider what sort of grain answers at market; and in this view he cultivates Autumnal wheat, in circumstances and soils favourable to the culture of this superior grain; selecting the varieties most suitable to him. In other circumstances, he raises April wheat; or he sows this grain in blank spaces where Autumnal wheat has accidentally failed.

PART SECOND.**BARLEY.**

It is very remarkable, that no kind of grain affords so much meal or flour per acre, as barley; that none exhausts the soil so little, in proportion to that meal; that none is equally favourable to the culture of the soil, in order to follow after turnips, and (in soils not very rich) to precede clover—thus tending to promote improvement; that no kind of grain ripens equally well in late seasons; and that none is equally free from the most common distempers: And yet the legislature, of late years, have discouraged the culture of it in a very serious degree!

It is an error to suppose, that high duties on malt and spirits can secure grain for the corn and victual markets, in bad years. They may become, and in fact they are, prohibitory against private family brewing, in most parts of the kingdom. This deprives the lower classes of the use of ale and beer, and drives them to the tea merchant and the distiller. In the mean time, the farmer overdoes the matter by oats or wheat. In

a late harvest, neither of them ripens fully ; and in seasons of mildew, the wheat fails very much. In this way the kingdom is deprived, regularly, in every bad year, of that valuable article of subsistence which the liberal culture of *barley* affords. A system that combines all these effects, impudently demands revisal, at least.

The culture of barley to advantage requires a free, dry soil, well pulverized, and cleaned of weeds. In coarse lands of a heavy description, and in wet soils, it fails ; but in suitable earth and culture, it prospers and ripens early and perfectly, in all parts of the kingdom ; returning liberally in every district of the Highlands and Isles. The value of this grain, in all years, is very great ; but in seasons of autumnal frosts and rains, continued long and carried to excess, and in years of wheat mildew, the value of it (when liberally cultivated) is immense.

This grain is perfectly adapted to the light and dry soils—the lime, dung, and green crop husbandry—and the general climate of Great Britain. It is known to grow in higher situations than wheat ; and as it ripens earlier than either wheat or oats, it is less precarious. The natural range of its spontaneous growth is confined to warmer climates ; and it prospers well under culture in more southern latitudes, than any in Britain. But, in every part of this kingdom, (in

proper soils and culture), it is well known, that when oats and wheat, in bad years, consist mostly of husk and bran, barley ripens, and contains a good deal of meal.

After *turnips*, barley has commonly been thought to answer uncommonly well; but in the *light soils* of Dumfries-shire, it is found by many respectable farmers that it answers better after *potatoes*. This is particularly remarked in the parish of Caerlaverock, and others near the coast.

In the parish of Canisbay, in Caithness, even under the old system of alternate crops of oats and barley, the latter generally afforded 7 returns, and in some cases rose to 11.* In the parish of Kincardine, and county of Perth, by dunging the pastures in November and ploughing in,—then harrowing smooth in spring, and giving a seed-furrow in the first days of May,—a field of $5\frac{1}{2}$ acres, sown with $3\frac{1}{2}$ bolls (19 $\frac{1}{2}$ bushels) of barley, produced 52 bolls,—being no less than 16 seeds, † Instances well authenticated, and still higher, have occurred in the Hebrides, ‡ In the parish of Forres, and county of Banff, it has not been uncommon to cut down barley, ripe, in 12 or 13 weeks after sowing it. ||

Can any really good reason be assigned for

* Statistics, Vol. VIII.

† Statistics, Vol. VI.

‡ Transactions of the Highland Society, III. p. 549.

|| Statistics, XVII. p. 451.

discouraging the culture of such a kind of grain; the staple of many parishes and of whole counties, both in Scotland and England, and the best resource of the whole island in late and bad seasons?

The varieties of barley are not correctly ascertained; but in Britain there are four known species.

1st, The finer sort, *hordeum distichon*, now distinguished by the name of *barley*, having long ears, full and large grains, and these disposed in two rows. This fine barley answers the best soils and climates, and is there considered about one-fifth more valuable than the next sort to be mentioned. §

2d, The four-rowed grain, *hordeum tetrastichon*; which has now the name of *Bear* appropriated. This answers a colder climate better than barley, and produces more bolls per acre there: But the grain in the market sells one tenth lower. ¶ There is also a greater number of small grains, which render it less fit for pot barley.

3d, What is called the *Russian*, or *Tartarian* barley, *hordeum hexastichon*, having 6 rows along the ears. This has been cultivated in climates and situations as cold as any in which bear has

§ Mr Stewart's lands, Hillside, near Lockerbie.

¶ Fairs of Dumfries.

prospered. It has answered in the parish of Crawford, in a high and cold district of country mostly adapted to sheep walks.* It is hardy, and has been called by some persons the *hordeum hypernum*, winter barley.

4th, The naked barley, *hordeum nudum*, having no glumes or husk, and resembling grain that has been shelled in a mill, is cultivated in Cornwall, but has not yet been found to answer in Scotland.

The farmers of this kingdom in general are disposed to cultivate one or other of the two former species. Accordingly, in the southern counties, and superior soils and climates, barley has been commonly sown; and, in almost all the rest, bear. Of the former, viz. *barley*, it is well known that several varieties exist; and these are marked by the colour, the awns, early or late ripening, and the like obvious and easily remembered characters. Of these discriminating marks, it is believed that some are produced by soil, season, or culture. A dark coloured variety of barley produced, a few years ago, rich crops in dry good loam, in the parish of Wamphray.†

The common distinctions are taken from place, climate, or soil. The early soils of the south of England produce the Rath-ripe, or Hotspur grain, which ripens in less time than any other sort. Scottish barley is also cultivated in England, and produces well, though not perhaps the brightest

* At Mr Hope's, Newton. † On the farm of Saughtrees.

samples. Lincoln barley is late and coarse. Battledore, or Sprat barley, has a thin skinned grain, and is strong in the straw.

Of the latter, viz. *bear*, hardly any distinction has been made into varieties. The species is rough and hardy. It is considered by most farmers about a week earlier in ripening than barley. The awns are also more adhesive to the grain, and separated with more difficulty, in preparing for market, by the fetttering process. It prospers in coarser soils and colder climates than suit barley.

With respect to *distempers*, barley is exempted from all sorts of *mildew*, general and local ; or if at all affected, it is only slightly, even in those cases of distemper which are fatal to wheat and oats. The *smut* does sometimes, but seldom, affect it ; and not, except to an inconsiderable degree. It is sown at so late, and reaped at so early a period of the season, as to prevent almost wholly any injury from *frosts*, excepting only in climates or situations very particularly exposed, and in seasons uncommonly bad. Sometimes it is partially *root fallen* ; which is, in some measure, prevented, by sowing at a proper depth, and rolling.

The greatest risk in the culture of barley, of all sorts, arises from the soil being either *too rich*, in which case the crop, if late sown, lies down ;

or *too wet*, either naturally, or in the course of the season, when the baird rises pale and unhealthy, and the crop turns out poor and thin. This disaster befel many fields of barley in Dumfries-shire, in the present year. A wet May, and first half of June, prevented the proper dry tillage and sowing ; and the crops were the worst ever seen. Earlier sown barley, that vegetated in dry weather, succeeded, and was a moderate crop. The present wet year, however, was, in potato lands, nearly as hostile to *oats* as it was to *barley*. The open pulverized soil became a perfect mire, and continued so for many weeks together ; and hardly any lands, except those broken up from ley, produced a full crop of that grain.

PART THIRD.**OATS.**

IT was observed as to wheat, that the rich lands and warmer climate of the southern parts of Britain are more favourable than the northern. This distinction does not hold, strictly, as to *oats*. They are for the most part of equal, or better quality in Scotland. This may depend partly on culture ; for here they are sown frequently in the best soils, which is not often the case in England. From the samples of oats long ago naturalized in Britain, under the names of Poland and Friezland oats, it is obvious that in these foreign countries this kind of grain prospers well. Yet the fen oats of Lincolnshire are seldom well published, or full bodied grain ; and in many cold and high districts, the late or common oats are often overtaken by frost before they are completely filled and ripened.

Oats appear to prosper better in a mild than a warm climate ; and they may be safely cultivated, where it would be hazardous to sow wheat. But much of the success of the oat farmer depends on

the variety that he sows. A soil moderately rich is requisite, in order to carry a full crop ; and if it be rather solid than fine, it answers as well. They prosper on good leys better than ordinary.

1. The only species of oats which are indigenous, both in Scotland and England, is the *grey bearded*, or the wild oat, *avena fatua*, still ready to appear in the fields, especially in poor soils. It always rises into stalk and ear, sooner than other oats, and it grows taller in poor lands ; and farmers have an opportunity of going through their fields and cutting off these ears, if they wish at that period entirely to rid their crop of it. Not many years ago, this wild and meagre species of oat was cultivated in many districts of Scotland. About 40 years ago, it was cultivated partially in Dumfries-shire, and generally, about 60 years ago, before the lime husbandry became general. It was asserted, at that time, that no other oats would grow, in soils now fertile in barley and wheat. No grain is known to be so hardy, either in poor soils, or in hard seasons ; for it will bear a crop where finer oats would hardly vegetate. In the parish of Duthil, in the counties of Murray and Inverness, when the frosts of August had overtaken the grain in 1782, the most substantial sample of oats at some of the mills was the produce of a spot of coarse ground, that had been ploughed, but not sown, and in which the wild

oat came up ! * The grain, however, is so empty, and the beards occupy so great a space, after some pains have been taken to remove them, that it requires from two to three times as many measures of this oat, as of other varieties now in culture, to produce an equal weight of meal. Yet this meal is not bad in quality.

Of *cultivated oats*, farmers in general make the natural division, taken from their practice, into *common* or *cold* seed, and *early* seed. Of both descriptions there are several varieties. It is an important object with most farmers, to have part of their crop of common oats, and part of early, in order to answer different soils, to suit particular seasons, and to divide the labours of harvest. In general, a dry season answers common oats better; while early sorts, requiring quick nourishment, are short of straw. In a season rather moist, the early sorts prosper and ripen better than the common sorts, and produce much more grain and meal. For a cold, late climate, (which is also frequently moist), early oats answer best—particularly such as are more hardy; and these are the early Red and the Sun oat,—the latter adapted to soft soils. In low, warm, districts, and sandy or gravelly soils, neither deep nor particularly rich, common oats prosper much better than early sorts, producing much fodder and grain, and that grain well filled.

* Statistics, IV. 315.

Distinctions might be made on other principles. The grey bearded oat would make one species; the naked oat, which falls out from the chaff without any husk, and is cultivated in Cornwall, would make another; and other species might be found among the black, the red, or the white oats, according to their several characters.

Early oats are known by the following, among other names; and the degree of earliness depends partly on soil and climate.

1st, *Church's oats*, considered as a variety of the *Poland oat*, and thought also the best variety, remarkably adapted to good rich loams, and very productive in grain and meal. This variety was taken from Scotland into Northumberland by a Mr Robson,* apprentice to Messrs Culley, who gave some of them to Mr Church. These, consisting only of 60 grains, were planted 14th June 1776; and were, for 25 years, raised on the same sort of soil, without sensibly degenerating. They have now declined in quality, but are still a plump round oat, resembling the potato oat; only larger in the grain, and thicker in the husk. They are sown from the middle of March to the end of April; and ripen, in proper situations and soils, about the first or second week of August. They require 6 Winchester bushels of seed per acre; and yield from 60 to 80 bushels on good rich

* Survey of Northumberland, 1794.

friable loams, after grass or turnips. These oats are liable to shake, and must therefore be cut before they are quite ripe, || and when the stalk, immediately below the ear, is of a pale pink colour, inclining to yellow. They are fit for the sickle ten days earlier than potato oats. In particular circumstances they have a bosom pickle, but frequently none; and when really good, they have no beard, or tail. This variety of select oats was generally cultivated in the rich districts of the north of England, and south of Scotland; until it was rather superseded by the potato oat.

2d, *Potato Oats*, which appear to be akin to the former variety, and answer in the same soils and culture with Church's oats, have been introduced into general notice about 15 years ago. They are the shortest, plumpest grain of the oat kind; and yield the largest weight in meal, generally (when good) about $1\frac{1}{2}$ stone Amsterdam, per Winchester bushel. Mr Stewart of Hillhead, on a rich field near Lockerbie in Dumfries-shire, had the largest return of meal per acre from this oat, that has been generally known; the field producing 90 bushels (15 bolls) per acre, and every bushel $1\frac{1}{2}$ stone of oatmeal;—in all, 135 stones per acre. The meal is generally thought rather inferior in flavour and quality, having a raw taste, and sometimes exciting a feeling as if thin membranaceous substances were mixed. The

|| Communications by Mr John Church.

potato oat has a bluish colour in the stalk ; and it shakes, like its associates Church's oat, and the Polish oat, more than any other variety. It is therefore to be sown only in rich and low parks ; and reaped before it is quite ripe.

3d, The *Dutch*, or *Friesland Oat*, has long been in cultivation in all parts of the kingdom. It was in some places called the *Barley* oat, from its figure, and early ripening, and from its answering on barley lands. It is liable to shake, like the Poland and Potatoe oat. The culture of it is not very common at present. In very good and low fields, the two former varieties are superior ; and in rich uplands, the *early red oat* is to be preferred.

4th, The *Early Red Oat*, which has also been called the *Peebles Early Oat*, § has been extensively known for about 16 years. The straw, glumes, and corn, are of a reddish colour ; the grains very small, but the husk thin ; and the meal rich in quality, and for the most part (in quantity) about $1\frac{1}{2}$ stone per bushel. This oat makes no figure on soils too dry or poor in quality ; but there is always more grain than one would expect on viewing the corn, and more meal also from the grain. It may be shaken, and will suffer in that way more than common oats ;

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§ By Messrs Culley, who considered it a different oat from the red oat of the midland counties.

but far less than any of the varieties formerly described. No grain whatever answers better in a moderately rich soil, and late or moist climate. It is believed to be the best oat that can be raised in the Highlands, and in the upper districts of the inland parts of the kingdom. The writer of these remarks had very fine meal of early red oats in August; but the produce in dry years is not very liberal. On the other hand, in 1800, after the wet season 1799, of two corn stacks, (the same dimensions in stook and stack), one of early red, and the other of common oats, which had appeared on the ground equally good, the former turned out so far beyond expectation, as to return double the value of the latter! Among these red oats, there is an occasional grain, quite black, which fills and ripens equally with the red. This valuable grain, like all other varieties, has been of great use for a series of years. In the neighbourhood of Moffat, it has lately given way to the next in order.

5th, *Sun Oats*, or, as they were first called, *Rising-sun oats*, have a degree of resemblance to the potatoe oat, both in the short plump form of the grain, and in the bluish colour of the stalks in the field. The sun oats have sometimes a tail, which comes off in thrashing. They answer soft soils better than any oat known; and have produced very amply in the highest cultivated lands in Evan and Annan. The seed has now gone into Eskdale, and the upper parts of Nithsdale.

This variety of grain is as early as the red oat, and yields in meal equally well ; but more plentifully in straw. For well manured leys and mossy soils, newly broken, it is the best oat in cultivation ; and, like the red oat, it would be very useful in the Highlands : but it is already beginning rather to degenerate.

Common, or cold oats, are not to be lightly esteemed, because early varieties are of great use. The true system consists in the judicious cultivation of both descriptions, common and early. In the low and warm vale of Dumfries, the soils in general are very dry and kindly, but not remarkably rich. Here, the common oat prospers better and more uniformly than any other ; and the seed has been known to sell as high as that of potatoe oats. It was common in former times to send for changes of common oats into Roxburgh, Selkirk, and Lanark shires. At present, in the corn market of Dumfries, the finest samples of common oats for seed may be obtained, on Wednesdays, in the proper season in March. The varieties of common oats are not very well marked ; or, such as are distinctly marked, are not very numerous.

1st, The *Blainslie Oats* have been long and well known as a good variety of the common, or cold-seed oat. They are not so short or plump as early corn ; and they require more seed per acre.

They do not ripen so early, nor yield so much meal from an equal quantity of grain. But in dry seasons they prosper much better ; and in all seasons they furnish more, and better straw, for the purpose of fodder ; and they grow in soils which would not be considered quite rich enough for early oats. In short, they answer better in a low and early district, though sown on more exposed ridges than suit most sorts of early oats ; and they are cultivated liberally on all the ordinary soils of early ripening districts. The meal runs from 1 stone to 1 $\frac{1}{2}$ stone per Winchester bushel. These, and other varieties of common oats, are always the first that are sown, being put into the soil in March.

2d, The *Angus Common Oat* is later in ripening than the Blainslie ; but the grain is fully larger. It is considered the best oat for ‘ poor, dry, hungry, rabbit warren soils ; and there it ripens early enough.’ *

3d, The *Tartarian Oat* has been in the kingdom about twenty or thirty years. It grows tall, and affords a heavy crop of corn and fodder, the head or panicle leaning all to one side ; and for this reason, as well as the closeness of the cups, (for which all common oats are less or more known), being little damaged by shaking winds, in comparison with early grain. It ripens slowly ; about ten days later than the Blainslie oats of

* Messrs Culley of Fenton.

Lauderdale. † In Wigtonshire, it once returned no less than fourteen seeds! §

The Black oat is by some referred to the early, and by others to the late or common oats. It is black in the skin, but well published in the corn; and the meal is white and rich. This variety (or species) of oats was cultivated extensively in Forfar and Kincardine shires. It has for many years been sown by individual gentlemen in the county of Dumfries. The soil in which it is deposited, is, generally, rather coarse; but in very poor soil the returns are mean.

Discordant accounts are given of the black oat, not only with respect to its earliness, but also to its being liable to shaking winds. The truth is, there are two varieties of the real black oat; one of them, cultivated by William Stewart, Esq. Hillside, is of the late ripening character; the other, very much resembling, and probably the same with the dark oat that appears in grains among early red, is undoubtedly early. Both are totally different from the *haver*, or grey-awned oat, which has been called *small oats*, and very inaccurately *black oats*.

† Highland Society's Transactions, II. 194.

§ Statistics, XVII. 585.

According to the above descriptions, all oats may be arranged either under the two general characters of early or late ripening ; or one species may be made of the *wild oat*, the same with the grey-awned ; one with two varieties of the *black oat*, late and early ; one of the *red*, with two varieties, the small Peebles, and the large Red oat ; and one species of the *white oat*, containing many varieties.

This kind of grain may suffer by *too late sowing*, which protracts the ripening, and exposes the corn to early frosts in autumn. It is more rarely injured, yet it has also suffered, by sowing *too early*, when severe weather has followed, cold and wet, of long duration, affecting the germinating seed, and also the rising blade. Common oats are most likely to suffer by late sowing ; and early oats by sowing too soon. These are also hurt by a season too dry ; and cold oats by a season too moist. All oats are liable to suffer by *shaking winds* ; but early oats far more than common. The cold-seed are, or should be, always first sown; yet early corn is first ripe : and, to invert that natural order of sowing, would injure all descriptions of oat crops. The difference in the period of ripening, betwixt the latest and earliest varieties, is no less than three or four weeks.

A bushel of common oats weighs from 36 to

42 lib.; and of early oats from 42 up to 48 lib. The proper quantity of seed, of early oats, is from 6 to 7 Winchester bushels, and the returns are about 50 bushels in good soil and culture;—in particular instances rising to 80, and even to 90 bushels per Scottish acre, equal to 1½ acre English. The quantity of cold seed is commonly 8 bushels, and sometimes 9 bushels per acre; and the returns from 40 to 50 bushels, rising sometimes to 80, per acre. But, when the season or climate is not good, or the seed, or the soil and management, faulty, the returns are much lower.

PART FOURTH,**PEAS.**

It is understood as a fact, by many practical farmers, that a full crop of peas, without manure, improve the soil nearly as much as potatoes or drawn turnips do, after manure applied! Yet, since the general introduction of green crops more adapted to the drill and horse-hoe, the culture of peas has greatly declined. It is very true, that peas have been sown in drills, to be worked by the plough; but this implement can be applied only during the first stage of their growth. If the peas be sown broadcast, they do not prosper nor yield a full crop, if the land be also foul with weeds, or deficient in calcareous manure. In a wet and late climate, they do not ripen; and in a showery autumn, the pods open, and the peas are hulled and totally lost, after being cut down.

On the other hand, in lands moderately clean and well stored with lime, and when the culture is good, the variety of seed well chosen, and the

season favourable, the pea answers well, and turns out both a valuable and improving crop. It is not uncommon in the Lothian husbandry, to sow peas intermingled with beans, in rows 27 inches asunder. The peas are supported by the beans; and they cooperate in smothering weeds along the drills; while space for the plough and horse is allowed; and the peas are useful, by way of bands, when the crop is cut down.*

All sorts of peas love a dry, calcareous soil; and they prosper best also in a dry season. It has also been remarked, that on an open situation, † they do better than in low, confined closes; and that, if sown broadcast, unless the soil be moderately clean, the peas do not effectually cover the soil and smother weeds.

Farmers distinguish the different species or subspecies of their field peas, by arranging them into *early* and *late* peas, and subdividing each of these into varieties. Of *early peas*, the grey is perhaps the richer; but the white boiling pea is the more esteemed variety. Of *common* or *late peas*, the most frequently cultivated variety is the grey small pea; but there is also a grey pea, the largest of the pea kind, which is very late in ripening. ‡

If the early pea be sown too soon in the sea-

* Brown on Rural Affairs.

† At Poldean and Marchbank near Moffat.

‡ Resembling the American Crown pea in the blossom.

son, it is more easily hurt by spring frost; as the common pea suffers more by autumnal frost. The late ripening peas are always first sown. †

When the principal intention is to improve the soil, the common pea should be chosen; and it should be thickly sown, and early in the season, in order to give a chance for the crop meeting, covering the ground, and suffocating all rising weeds. But, when peas are sown for the grain, the common variety should be sown less thick, or early varieties ought to be preferred. It must not be forgotten, however, that early peas require a fully richer soil.

The climate of most of the west of Scotland being rather moist, or at least rather uncertain about Lammas and Michaelmas, is not very favourable to the ripening and harvesting of this grain; and less so to cold than to early sorts of it. In high and late climates, particularly if moist also, the cold-seed pea is uncertain; and if the land be too rich, and the crop thick, in low and close places, it rots instead of ripening. Early peas answer better than common, in late and moist climates, and in rich and close fields. The common pea does well in dry, open lands, in an early ripening climate, and not too rich a soil, but moderately clean, and well mixed with lime. If the coarse grey hog pea of the southern

† There is also a mottled pea in Berwickshire, which may be sown in May, is early ripe, but produces very inferior straw.—*Kerr's Survey*.

district be different from the common grey, it may account for English farmers finding it ~~an-~~
~~swer even on~~ stiff clays. *

If peas are sown early, in dry weather, and in dry and light soils, they answer well to be ploughed in with a shallow furrow; but, in other circumstances, they are harrowed in; and in this case they are sown as soon as possible after the seed furrow is opened.

Once in the last fifteen years, in 1807, the field peas were attacked by green *aphides* in the blossom, and were found totally abortive in grain. But, in the same period, the crops have repeatedly suffered by *wet seasons*, and have been very poor and unproductive. The writer of this paper has had ten seeds from the common grey pea; † but he has also had his pea crops to plough down; and this ought always to be done when the crop fails, before the weeds have time to run to seed.

The present year, 1811, has been very unpropitious to the field pea, owing to the long continued rains during May, and the first fortnight of June. Whole fields of them have been totally abortive. In England, even in a wet season, the pea crop succeeds when dibbled on the layer. ‡ In Scotland, the practice of sowing peas, or planting any green crop on ley ground, is hardly known; excepting a few particular instances in

* Farmer's Calendar.

† In light soil, after oats.

‡ Farmer's Calendar.

the culture of potatoes. It is quite certain, however, that crops on a layer prosper better than in the best fallows in a wet season. The present year has afforded full evidence of this; for, in many of the best worked and cleanest soils, oats and barley have almost wholly failed; while, in old leys, the oats have been most luxuriant.

About a score of varieties of the garden pea are now cultivated. It would well merit a more complete set of trials of this grain in the fields. But it would be improper to plant, at first, in poor or foul lands. They should be tried in the fallows, or on the ley; in order to do them justice, till naturalized in the field. Experiments on the white garden pea were made in the fields in Berwickshire, * but not persisted in. † As the lands tire of potatoes and turnips, peas will come in by way of green crop, and prove a valuable auxiliary. In moist and late ripening climates, it is needless to try late varieties; but these will prove most valuable in dry early climates, on lands moderately rich in lime. It may almost be predicted, that, in Scotland, the pea will gradually regain its lost reputation; and that machines for dressing this grain will be more common. The Peebles grey pea, and that of the lands of Pendreich in the parish of Laswade, were, some time

* There have been similar experiments made in other places; but the pea has been supplanted by other crops.

† Survey of that county.

ago, in estimation for seed.* As the pea is incomparably superior to the bean in feeding swine, according to the best farmers of England, and the first authorities, † it is natural to consider them in some degree superior in feeding other kinds of stock ; and since it certainly is possible, by the drill-culture and the hoe, to obtain a full crop, and make the soil as clean as a garden-bed. ‡ And since peas, in full crops and good culture, are highly fertilizing, even without manure, it is therefore to be hoped, that farmers who wish for these advantages, and have just ideas of the consequences of a variety in their green crops, will sometimes introduce the pea, in suitable soils and climates. A rich full crop of this grain smothers weeds ; and, by covering the soil closely, and causing a degree of putrefaction at the surface, leaves it moist and rich. After such a crop, the farmer, in many districts, has better barley or bear, than after his turnips ; and therefore it is classed among enriching crops.

* Statistics, X. 277. and XII. 3.

† Farmer's Calendar. ‡ Kerr's Survey.

PART FIFTH.

BEANS.

ALTHOUGH the drill culture is admirably suitable to this crop, and it prospers best on strong wheat soils, affording the farmer a double advantage in crop and culture, and naturally interposing between two crops of corn; yet, from the late ripening season of the bean, it rather protracts the sowing of wheat; and, from the want of ready markets, the culture of this grain does not seem to extend.*

It is agreed on, by the most respectable farmers and authors, † that what is called the *Horse-bean*, answers best in field cultivation. *Tick-beans* have been tried in Berwickshire, without affording equal satisfaction. The larger sorts are more properly adapted to the garden.

Neither is there any doubt of the proper situation and climate for beans. They must be early

* Kerr's Survey.

† Young, Kerr, and Brown.

put in; and they require long time to ripen; of course, they are unfit for late ripening climates. A strong soil, and favourable situation to hasten the maturation of beans, are essential to their success: The same soil and climate are proper for them and for Autumnal wheat.

In the Scottish mode of culture, the Lothian farmers apply dung to the land intended for beans, and sprinkle a few peas among them, of the cold-seed varieties. In Berwickshire, the bean lands are not so commonly dunged; but peas are mixed or dropped with the seed. † In both cases the beans are laid down in drills, and worked by the horse-hoe, in order effectually to clean the soil. In most of the carse lands in Scotland, beans enter as a regular crop into the rotation. They prosper well in deep loams, or sleech; and are sown in smaller quantities in most of the lower districts. The practice of sowing broadcast is now justly fallen into desuetude. The Scottish farmers commonly allow an interval of 27 inches betwixt row and row, with a view to render the horse-culture effective.

In England, where the climate is earlier in general, the culture of beans is more extensively carried on; and, having a better market, and a more numerous population, the farmers plant them in drills at less distance, and work them with hand-hoes.

† Brown on Rural Affairs.

Notwithstanding the preference which is given in field husbandry to the horse-bean, it is probable that some earlier variety may be discovered, to answer equally well for culture, † and, by ripening early, may hasten the labours of the husbandman in preparing for wheat in succession. Should this happen, the bean culture may possibly be extended into later climates and other soils, instead of being confined, as it is at present, within the strong soils of low and early districts.

Against the attack of the *collier insect*, the bean farmers know of no means that can either prevent the malady, or cure it.

The culture of the Bean has been very particularly attended to, on the great scale, by Robert Brown Esq. at Markle; whose account of his mode of treatment, and of the result, cannot fail to prove useful to others. It will be found in his lately published, and very excellent work on Rural Affairs; and it is the more likely to meet with attention, that it was approved of by the Society of Arts in London.

† Such, perhaps, as the early small bean of Portugal and Spain.

POSTSCRIPT.

SPECIMENS of the several kinds and varieties of grain and pulse, alluded to in the foregoing Essay, are now in the act of being collected, and will be transmitted to the Honourable Society. In the mean time, it is hoped these varieties have been so described as to render them easily obtained in sufficient quantities; and also to enable farmers and gentlemen to learn, from the most respectable sources of information, how they have turned out in actual field culture, and on such a scale as to warrant an opinion of their comparative merits.

ESSAY

ON THE

MOST COMMON DISTEMPERS OF CORN AND PULSE PLANTS:

CONTAINING

PRELIMINARY OBSERVATIONS, AND THE SUBSTANCE
OF THREE ESSAYS,

1. On the Blight, *Albigo*;
2. On the Smut, *Ustilago*; and,
3. On the Mildew, *Rubigo*, *Rust*.

By the Rev. WILLIAM SINGERS, D. D.

THE principal object of this paper is, to point out the symptoms of *blight*, *smut*, and *mildew*; and to trace, as far as the present degree of knowledge on the subject shall enable the author, their *causes* and *remedies*; or, in such cases as afford no remedy, to point out the best known means of *prevention*.

A degree of confusion prevails in the names

of these distempers in corn. *Smut* is known almost by every person as a peculiar malady. *Blight* and *mildew* are often used as words of the same import by farmers, and botanists also. Some farmers of great experience have made a proper distinction ; but it has not been so clearly marked as to enable the public to distinguish them accurately.

In seasons of *mildew*, *blight* also frequently prevails. The *spotted distemper* is assisted, in its formidable ravages, by other causes which *prevent nourishment* in the corn. If, to these evils, *abortion* be superadded by severe weather at the period when corn is in flower, and if the crop happen to be also much *laid down* by winds and rain, so as to *crush* the stalks, and to prevent filling and ripening; the accumulated effects of all these diseases and accidents cannot fail to be very severe.

Such was the season 1808 with regard to the wheat crops. In some places there was little comparative injury ; in others the loss was exceedingly severe, amounting to one third, or one half of the expected produce. In some uncommonly bad cases, the total destruction of the crop ensued ; and ‘whole fields of wheat were mown and carried into the straw-yards as bottoming, or dried like hay for litter.’ In one instance, ‘a removing tenant in Northumberland absolutely refused to reap or mow, or to remove his last crop of wheat, alleging, that as it was utterly useless to himself, though of some use to con-

' vert into manure for his successor, he was not
 ' liable to the charge of cutting and removing it
 ' for the sole benefit of another person.' * In
 that season, however, though *mildew* operated se-
 verely, there was also *abortion*, and heavy losses
 by *lodged corn*. The preceding year, 1807, af-
 fered a good and plentiful crop of wheat in ge-
 neral; yet there occurred some instances of *mil-*
dew; and ' one field of *spring wheat*, of fifty acres,
 ' in high order, produced only six bushels per
 ' acre, of altogether unmarketable and almost
 ' useless grain.'

The wheat crop of 1804 having been hurt by
 distemper, and particularly by *mildew*, the Duke
 of Bedford ordered an accurate comparison to be
 made betwixt the grain of that year, and that of
 the two former years. The result was, that, in
 quantity and quality taken together, the defici-
 ency was no less than 56 per cent. in the produce
 of 1804, on his Grace's farm. † And according
 to this computation, it is evident how very se-
 vere the loss may be on particular farms, and
 how serious the public danger, if wheat alone be
 depended on for bread corn. The wheat and
 flour imported betwixt the 10th October 1804,
 and the same date in 1805, amounted nearly to
 one million of quarters; being one $\frac{1}{8}$ eighth part
 of the computed annual consumpt of this island.

* Kerr's Survey of Berwickshire.

† Pamphlet on the Mildew, by Sir Joseph Banks.

‡ By some, the annual consumption is computed at six-
 teen millions of quarters.

But the deficiency of former seasons has been much greater. The average price of wheat in 1805 was 10s. 10d, per bushel ; but that of 1800 was 14s. 1d. ; and that of 1801 was 14s. 8½d., being the highest average price of any year ever known. It was the bad harvest of 1799, and an unfavourable set of weather affecting the flowers of wheat in 1800, and causing a good deal of abortion on the whole ear, or, in many cases, on one side (the south-east), that occasioned these uncommonly high prices. The year 1725 has been mentioned as a season of great and general losses by mildew or blight in wheat.

The losses that are sustained by the particular distemper called *smut*, are capable of being, for the most part, if not entirely, prevented by intelligence and attention in the management of the seed.

Blight is occasioned by a great many different causes ; and some of these are not capable of being subjected to human controul, while others may be very materially or wholly counteracted. It is the same distemper with *albigo*.

Mildew, which is here taken as the same with *rubigo*, sometimes called *rust*, is a distemper of the most serious description ; the destructive effects of which are so rapid, and so extensive in wheat crops, as to require the utmost efforts of intelligence and attention, in order to prevent or counteract them. This fatal malady is now ascertained to be either general or local ; and it is

of different colours, though the dark brown is the most extensive and destructive to the wheat of this kingdom.

It was for another purpose than for this paper, that a mass of well authenticated facts, chiefly in relation to a *local oat mildew*, affecting *wheat* also, was compiled. In doing this for a county survey, the author was led to remark the distinctions betwixt local and general mildews, and between the common brown spotted mildew, and other varieties of the same distemper. The rise and progress of a local and pernicious mildew, in particular parts of the county of Dumfries, have been correctly ascertained.

Conducted (in order to do justice to this undertaking) into a wider field of investigation than had at first appeared necessary, the author has been led, not only to distinguish from the *mildew*, but also to describe the *smut* and the *blight*, and to point out in what sense these terms, often confounded together, ought, in his view of things, to be understood.

All distempers, both in plants and animals, are understood very imperfectly in a strict sense. But there is a general understanding with respect to many of them, as to their cause and their symptoms, and also to such means as are found of use to prevent or to remove them. A remarkable difference of opinion exists as to the immediate causes of the distempers of corn. The subject is not by any means accurately understood. In the

state of imperfection and uncertainty in which these distempers are involved, it would be unreasonable to expect, and presumptuous to offer, any thing under the character of a complete Essay. But the author of this little work has endeavoured to make the best use that he could of a considerable number of important facts, taken in connexion with such authentic information as the public have received from other quarters, communicated by gentlemen of the highest character.

The result of all is now presented in the following Essay, which consists of Three Parts, and comprehends a disquisition, 1st, On the Blight; 2dly, On the Smut; and, 3dly, On the Mildew, in Corn,



PART FIRST,

ON THE BLIGHT IN CORN.

THIS distemper is denominated ‘*albigo*,’ and in appearance it gives plants a pale and starved colour and form. Blighted corn loses its natural colour, and its thriving appearance; puts on a pale sickly hue; and, in the worst cases, rattles in the straw and ears; discovering a want of sap in the former, and little better than husk in the latter. The straw does not appear spotted like that of mildewed corn; nor does it hasten so rapidly to break down,

Many causes are known to produce blight in corn, at the head of which are frost mists, followed by sunshine in immediate succession. If a shower of rain happily intervene, the blight is in a great degree, if not wholly, prevented. In open situations, where the wind prevents the settling of these frost mists, the danger is less. It is hazardous to sow late ripening corn at a late period of the season, in situations liable to these cold

mists; and it is not quite safe to sow too early. Garden peas are affected with early frosts, especially the Charlton species; and field peas, if late in ripening, suffer if exposed to the same agents. Even oats, too early sown, if assailed by severe weather, are most materially injured, particularly early varieties.

Rainy weather, long continued, prevents plants from transpiring properly, and gives them a pale sickly hue; such as flax exhibits when it suffers from want of sun light and heat, and in which condition the farmers call it 'fired.' A similar effect is produced on corn. Botanists call this distemper by a name derived from something conceived analogous in the human frame—*chlorosis*; but, in the sense in which blight is here taken, this is one variety of it; and so also are many cases of *tubes*, or consumption, which may be traced in plants to various causes.

Blight is ascribed in some cases to *lightning*, a power whose influence over nature is equally sudden and irresistible. A stroke of lightning would inevitably destroy corn; but it would blast or consume it, instead of causing this pale emaciated appearance. A highly electrified state of the atmosphere may produce effects of great importance, unobserved by mankind. It actually does so, in many respects; and the cause is only supposed, while the effects are manifest. Such a state of the atmosphere is known to encourage *mildew*, as will be mentioned afterward. If it al-

so produce *blight*, it may possibly operate by sudden and violent change of temperature. A thunder shower is generally salubrious to plants in a high degree; but a highly electrified state of the atmosphere without rain, may have different effects. If an excessive degree of luxuriance be occasioned, it may be followed with debility, as frequently happens in a case of overgrowth.

The whitish thin coating of mouldiness, (Linnaeus's *mucor erysiphe*), is of vegetable origin, and is a species of blight. It appears on the maple, the hazle, and the hop; on tussilago, dead nettle, and other plants. It also appears (or something akin to it) on the grass of meadows too much watered in warm weather; but it is not understood as a distemper in corn.

The whitish gummy or slimy coating that appears on some plants, has been supposed to be of animal origin, the production of aphides; but this account of it appears rather doubtful, and it may possibly turn out that aphides feed on it, rather than produce it. This, however, is only mentioned as conjecture. But it seems highly probable that the red gum which affects corn with distemper, and is more frequent in England than in Scotland, may be referred to a similar origin. Probably it may be a concretion formed out of the substances transpired by plants, in combination with others floating in the air, when the weather is very dry and warm. The natural remedy is believed to be moderate waterings, in the cool

of the morning and evening. These, if practicable, should be given with suitable precautions against frost, or too sudden and high a change of temperature. In the case of corn, they are seldom practicable. But when blight, or consumption, are occasioned by unhealthy or unsuitable seed; or by the selection of improper soil for particular species of corn; or when the produce is pale and emaciated, in consequence of planting the same grain too frequently in the same soil, or of putting it in too deep or too shallow; or when the soil in which it is deposited happens to be too dry to nourish the corn, or too wet for it to prosper; or when the subsoil is unfavourable, in consequence of neglecting to drain and to plough deep; or when the soil is destitute of solidity, as happens often in spots of mossy land; or when it is too solid and impervious, as in till or indurated clay;—in all these cases it is obvious that a diligent and intelligent farmer has much in his power to do, in order to prevent his corn from coming up weak and unhealthy.

Insects also, in some cases, consume the small fibres at the roots of grain, and occasion *albigo*. Correct fallowing, and suitable manures and culture, are the remedies.

PART SECOND.

ON THE SMUT IN CORN.

THIS distemper occupies the whole ear; and instead of grain, the affected plant exhibits nothing but a black soiling mass of dust, not unlike lamp black. The smutted ear is, under one form of the distemper, conspicuous to the eye at a distance; and, although the distempered head contains nothing but black dust, this dust is blown away as the grain ripens on the sound ears contiguous to it, and it does not much, if at all, discolour the general produce in grain. But there is another more extensive and pernicious form of this distemper, under which the smut is covered by a membrane, which confines the dust until the grain is thrashed out, when the smut-balls are apt to burst, and the grain in general becomes discoloured by their soiling dust.

Wheat, oats, and barley, are liable to *smut*; but wheat suffers most materially from it, unless precautions be taken. Oats and barley suffer on-

ly in particular seasons, and in a slight degree in comparison with wheat ; and are never attacked by the last described species of the malady.

Although particular seasons appear to favour this distemper in oats and barley, it is well known, that in order to prevent it, the farmer must attend principally to *the seed*. Mr Kerr of Ayton, in Berwickshire, (the intelligent author of the Survey of that county published in 1809), made an experiment in 1807, with a view to ascertain how far a smutted ear growing in the field was capable of infecting other plants growing near it. He chose the time when the grain was forming, and the flowers of the wheat going off; and having pulled some blackened ears, he whipped with them a tuft of growing wheat, so as to soil and blacken all the ears of it ; but, in harvest, this tuft was entirely free of smut.* The result of this trial corresponds with the uniform observations of the farmers on this point ;—smutted ears growing quite close to, and intermixed with clean ears, and never communicating infection to those ears which grow up at the same time.

As to *the seed*, if it happen to be in any degree discoloured with smut, there is not an intelligent and experienced farmer in the kingdom that will venture to sow it, without pickling, in order to a cure. Such as have, either for experiment, or from some other motive, made use of seed blackened with smut, without pickling, have generally

* Page 232 of Berwickshire Survey.

found their crop distempered, and sometimes to the extent of two-thirds of the whole. †

It may therefore be received as a known fact, that smut, in general, arises from a distemper in the seed : And, fortunately, it is one that admits of an easy and effectual remedy.

It commonly happens, that all the stalks which grow from the same grain of seed are either quite free from smut, or quite full of distemper. Instances have indeed occurred, very rarely, of one stalk smutted, and one sound, from the same grain of seed. There is no doubt of the fact, though a rare occurrence. Most commonly smutted seed is known by the colour. The stalks manifest no signs† of distemper till the ear ought to expand ; and there it appears. There seems in general to be no shade or degree in this evil ; the whole ear is, for the most part, totally diseased.

Botanists call this distemper *ustilago*, and ascribe it to a small fungus which occupies the whole ear, and turns it into a soiling black powder. ‡ The contents of the smutted ear do, undoubtedly, resemble the seminal dust of the smaller fungi ; but it seems difficult to conceive, small as the microscopic seeds of these extremely minute mushrooms are, how they can pass from the

† Farmer's Magazine, Vol. IX. page 426.

‡ Willdenow, § 331.

† The plants affected by this complaint generally exhibit a dull glaucous hue in the straw, even before the ear shoot out ; though, in other respects, these plants then seem equally vigorous as the rest of the crop.

seed into the ear, leaving the roots and stalk unaffected!

This, however, is known to be the fact, that whatever the mode of transmission may be, the distemper passes in that way from the seed, affecting the whole ear, and no more of the plant. It seems as if the seeds of distemper were so minute, as to pass into the *plumule* along with the nourishing fluid which the *cotyledons* transmit ; or it may be considered as a natural *inoculation* taking place in the *plumule*, as soon as it forms, in consequence of the seeds of the smut fungus adhering to the grain ; and it has been considered as a *gangrene*, to which the ear of the corn is exposed in consequence of the seed being smutted.

If the distemper be in any case favoured, or partly occasioned by a wet season, as many think, then we must suppose that the rapid and more plentiful ascent of sap transmits, with proportionably more ease and certainty, the malady from the smutted seed ; but we cannot suppose that it can be created by a wet season alone. In oats and barley, it sometimes appears more abundantly in a fine season, when the crops are otherwise better than ordinary. A wet season (also warm and favourable to the growth of healthy plants) would promote the putrefactive process in such as are highly diseased, or dead : but the black dust of smutted grain is not a putrid ear ; nor is it easy to conceive how that part of the plant could be

so far distempered as actually and entirely to rot, without affecting the stalk, leaves, and roots. It is therefore more natural to adopt the opinion of men of science, and to ascribe this distemper to that noxious, but very minute family of vegetables, the fungi, whose microscopic seeds much resemble the particles in an ear of smutted grain. According to botanical writers, the smut (or, as they call it, ustilago) is a distemper most incident to the *gramina*, under which they comprehend corn; though sometimes it appears also in other plants, in *scorzoner*, *tragopogon*, *goats-beard*, &c. as we learn from Linnaeus and Willdenow.

Preventive means only, and those in the seedling of wheat, are thought to succeed. We are told that if grain has been kept in damp places—if smutted seed be sown—if corn be deposited too deep in the soil—or if the soil be also rich and moist—there is danger; but that, when distemper once appears, there is no remedy.

Practical farmers know perfectly, that smutted seed produces a diseased crop; but that the dampness of barns, the depth of sowing, or the richness and moisture of the soil may also contribute to this distemper, as has been thought by some, does not seem to have been correctly ascertained. They may favour the distemper, and hasten its advances, though they should not create it.

If the smut were a symptomatic disease attendant on some other, it would be of primary importance to inquire into the cause and nature of

the previous distemper... But there is none such, as yet known; and there does not appear to be reason to suspect any.

With a view to prevent this malady *in wheat*, farmers have recourse to the following expedients:

1st, They take care to select their seed wheat from samples as fair as possibly can be found, and as free of the smut black.

2d, They are at proper pains to wash, and float this grain; scumming off the light corn, weeds, and impurities. If there be any smut-balls, they are separated in this manner. This operation is not indeed regularly or uniformly performed; but hardly any farmers of experience neglect the next.

3d, The intended seed is either steeped in, or at least wetted with, some lye, consisting of stale urine, salt and water, wood ashes; or some other; and afterwards the dry flour of lime is applied, in order to imbibe the moisture, and render the seed fit to be sown.

4th, Some farmers are of opinion, that by keeping wheat over year, the grain is much less susceptible of smut, and steeping and pickling less necessary.

5th, It is thought by other farmers, that a gentle kiln-drying destroys the smut, and renders it incapable of reproduction.

The first and third of these expedients ought in all cases to be used ; and if they are, and the clean grain is put on clean floors and in clean sacks, they will generally prove effective as preventive remedies.

If old wheat be at all steeped for seed, in the pickles, a selection must be made ; stale urine being sometimes too powerful for it. Salt and water ought to be preferred ; and after the seed has been pickled and limed, it should be immediately sown.

New wheat pickled with stale urine, and dusted with lime, undergoes less risk by keeping for a short period than old wheat does, treated in the same manner ; but still, as there is a degree of risk, it ought never to be prepared in that manner till it is ready to be instantly sown.

The washing and floating is first performed in some large trough, tub, or other vessel ; the grain being well and often stirred, and all that floats taken away, and water being added after water, till it is not in the least degree discoloured. It is then sufficient to spread the washed grain equally on a floor, to wet the whole of it with a mop or broom dipped in stale urine, and to have the seed grain immediately well dusted with dry flour lime, turning it with a barn shovel, till every grain is white all over ; and then it is fit for being immediately sown.

By these long established methods, the principal wheat farmers in Scotland are effectually secured against loss by smut.*

Old wheat being sooner injured in its vegetative powers by the use of pickles ; and kiln-drying, if carried to an improper degree, having a similar effect on any sort of grain ;—these preventive methods require more than ordinary attention in conducting the operations.

There can be no doubt, that by all the above expedients the vegetative power of the smut fungus, or at least the contagious power of the smut powder, must be destroyed ; and if light and defective grain be removed also by floating, the remainder proves an equal and valuable sample for seed.

It is farther to be observed, that by the pickle and the lime together, the seed becomes less palatable to ground mice, and to birds and insects ; while these substances being, in a very minute degree, absorbed by the adjoining soil, must contribute, at any rate, in that degree, to fertilize it, as a kindly mixture for the grain, in its first stage of growth ; though too inconsiderable to enrich it sensibly afterwards.

* The author of this essay, not having quicklime, dusted some wheat seed, after it had been wetted with stale urine, by means of dry peat-ashes, in place of lime ; and there could not be discovered a single smutted ear in two acres of the crop, which were the whole of the land sown with it.

According to the judicious experiments[†] made by the Reverend Arthur Young, Esq. secretary to the Board of Agriculture, washing well in common water reduces the smut from the proportion of 3 to that of 2. Old wheat left long in the steeps does not vegetate ; but if well washed, it produces a crop with little distemper, though no steep or lime be used. Very black smutted grains are not cured by the brine and lime ; (but Mr Young did not use the stale urine, which in Scotland is preferred as a steep before the brine of salt and water.) In the cure of the darkest samples, it was of consequence to allow the seed a sufficient number of hours in the steeps employed, which consisted of lime water, lye of wood ashes, of arsenic, and other substances ; and sometimes 12 hours, other times 24 hours, were necessary to destroy the smut entirely. These experiments were made with the darkest and most smutted seed that could be found. In ordinary cases, when the sample is pretty fair, and the grain well washed and floated, or scummed, the practice of wetting with a mop, and of dusting with dry lime, (as established in the wheat counties of Scotland), may be relied on ; And it would certainly be hazardous, even with new wheat, if it were left too long in the steep, as instances of its vegetating powers being destroyed in that way, have occurred again and again. Old wheat would

[†] Farmer's Calendar.

undoubtedly suffer by lying* long in the steep, or wet heap; but if well chosen and washed, old grain hardly requires a steep, as the smut loses its destructive power in a considerable degree, by keeping the grain properly in stack for some time; and if pickled at all, it should only be moistened, and then immediately dusted with lime, and sowr.

Barley and *Oats* are so seldom very materially affected with smut, that few farmers use any precautions, except selecting fair seed, in order to prevent it. Seed barley ought however to be floated and washed, though it were only in order entirely to get out the seeds of certain weeds. Fine samples of early oats may be treated with advantage in the same way; afterwards, to wet with pickle, and dust with lime, is the natural process, if the sample be suspected.

* Sudden and unexpected falls of rain sometimes prevent the farmer from sowing wheat after it has been steeped and limed. In this case, the grain ought to be *immediately* spread abroad *very thin* in a well aired granary, where it will require to be frequently turned, and always till it becomes dry. If this is attended to, it will vegetate very well after lying several weeks.

PART THIRD.**ON THE MILDEW IN CORN.**

HERE is a very striking local distemper affecting the *Oats* of certain farms in different counties, and, among others in the county of Dumfries, in the parish of Ruthwell it has existed for above thirty years, and in the parishes of Johnstone and Wamphray, more than fifteen. Year after year, without intermission, the mildew has affected *the oats* in particular farms and places ; always greatly damaging the crop, and sometimes totally destroying it. In Ruthwell parish, there are various farms where this distemper is well known to exist *regularly* ; in the parish of Wamphray there is one farm particularly affected, and in that of Johnstone another ; while the contiguous lands also suffer in a less degree. Similar instances occur in the parish of Closeburn, and in one or two others in the same county of Dumfries. The *oats* are every season affected, in these places, less or more ; while *barley*, and all sorts

of green crops, are almost, if not wholly, safe. In all the rest of the county of Dumfries, no such regular distemper *in oats* occurs; and if it has occasionally occurred, it was not to such a degree as to excite much notice; nor is there any tradition of such a regular malady in that kind of grain, till it appeared about the times above mentioned in Ruthwell, and also in Johnstone and Wamphray, and other places. *Wheat* is partly cultivated on the farms liable to this oat mildew; and in all such instances as have occurred, the wheat also, as well as the oat crop, has been affected.

A partial appearance of something resembling this oat mildew, in particular spots, on other farms where it has not formerly been heard of, has excited, in the present year 1811, a good deal of surprise and reflection.

The known facts relative to the commencement, progress, and symptoms of this pernicious malady, are these, viz.

' In the parish of *Ruthwell*, about 30 years ago, the mildew in oats first appeared, on the farm of Bowerhouses, on that of Comlongan, and on the glebe lands;—these places being about a mile and a half distant from each other, in a line from east to west. Barberries had been, about five years before this event, planted in the hedges adjoining the fields, where the first ravages were made in all these places.
' The malady quickly spread into the neighbour-

‘ ing farms, and has since over-run the greater part of the parish ; though it is still most virulent where it first broke out, and where the barberry hedges still remain ; and a few ridges next the hedges have generally suffered most. The period of attack is commonly about the middle or latter end of August.’ *

In the parish of Wamphray, the first appearance of mildew in oats was in 1795, when a small field in the farm of Wamphray-gate, or Newhall, then possessed by Mr Tod, which had been limed on the surface before it was broke up out of ley, was carrying a rich crop of oats, valued, as it began to whiten, at nine guineas per acre. No distemper was dreaded until the oats were beginning to ripen ; when dark brown spots appeared on the stalks, which gradually broke down ; the grain and whole crop turning out good for nothing. Next year, 1796, the same distemper appeared, in another small field contiguous to the former ; and this new field was also broken up from ley, but it had *not* been limed. In the following years, the malady appeared, less or more, in all the oat fields within about one-fourth of a mile. It had extended across roads, and across the water of Wamphray, where it runs in a deep ravine or linn, having steep sides of about 100 yards wide, and 20 yards deep ; and the mildew now appeared in the oats on the other side of the

* Communications by the Reverend H. Duncan.

stream. Such an event was so totally unexpected and uncommon in that place, that it excited a considerable degree of surprise ; no such thing appearing any where else within the parish of Wamphray. After having extended for about one-fourth of a mile, its advances were not continued farther ; but within something like that compass, it has continued, less or more, to affect the crops of oats, ever since ; and one field of wheat, that was valued at a high price, was almost entirely destroyed by it :—Barley and green crops not being sensibly affected.

In the parish of Johnstone, on the farm of Kirkbank, a similar distemper began about the same time ; and its progress and continuance have been quite similar, in all respects.

The author of these pages was ordained minister of the parish of Wamphray in 1794, and he was translated to the neighbouring parish of Kirkpatrick-juxta, in 1799. In this last year, part of the oats on his own lands in Wamphray, happened to be reached by the spreading mildew, then in the fourth year of its progress. He examined them with the utmost attention, along with Edward Anderson of Stenrieshill, one of the Justices of the Peace for the county, and a practical farmer of experience and intelligence. They made use of a small magnifying glass, and examined every part of the mildewed plant. At the roots, nothing whatever could be discovered resembling distemper ; neither the small fibres, nor any part

of them, appearing affected. The *stalk* was perfectly sound, from the root up to the second knot; and above this, it was all spotted with dark brown substances, rough to the touch, but showing no signs of insects. On the *ear*, the small branches were dark and brittle; and there appeared frequently a livid circle round the grains, at their junction with their pedicles, or the small branches by which they were supported. Some of these grains were mere husk; and others had been filled only in a very partial degree. It was common oats; and about the season when the fields begin to whiten under the ripening process. No satisfactory opinion could be formed respecting the *cause* of this distemper. In the first affected field, it was thought that, by the lime, the land had become too loose, and the corn lost root. The next instance, of a field not limed, entirely subverted that theory; and when the mildew spread for a certain extent, went across the stream and the deep banks of Wamphray water, and continued to hang on all the oat crops within a certain distance, year after year, the facts became quite perplexing.

What occurred about the same time in the parish of Johnstone, on the farm of Kirkbank, afforded equal surprise in that quarter; but no light whatever as to the origin of this destructive evil. Mr John Aitken, the tenant, (a man of a large portion of natural sagacity), was disposed to ascribe the mildew to the lime husbandry; he

recalled a similar occurrence in the county of Ayr, and that after many successive years of heavy losses, the people sowed out their fields, and left them in grass.

In 1810, when the survey of the county of Dumfries was committed to the author, he observed, near Dalton, some wheat affected by mildew, and found that the seed had been got at Liverpool, and was the produce of America. This occurrence was more striking, as a field of red wheat growing near the other, and the produce of grain that was naturalized in the county, appeared quite free of distemper. Lieutenant-Colonel Murray, a gentleman of the highest character, informed the author on the same day, that he had obtained seed wheat, also from Liverpool, originally of America, the produce of which was *always* mildewed.

Colonel Murray also said, that he had seen the light mildewed wheat of this country sown for want of better seed; and yet the produce was fine plump grain! He also informed the author, that in the neighbourhood of Comlongan, it was believed that barberries had some effect in creating mildew.

Mr Thomson, at Charlesfield, had great and heavy loss in his crop of white wheat in 1809, which he ascribed to dark hazy weather, warm, and inclining to bring on putridity.

Mr John Church, at Hitchill, had 30 acres of wheat mildewed in one year; and there was a

barberry hedge not far from that field, which he has since grubbed up, suspecting that it may have contributed to that mildew. This very intelligent and respectable farmer thinks red wheat less in danger than white. His father is of Norfolk; where he says the barberry has been thought (for a century) to be injurious to grain, as contributing to this distemper.

After these communications, the author obtained from the Reverend Henry Duncan, minister at Ruthwell, a full and authentic account of the rise and progress of the mildew in oats in the parish of Ruthwell, on which he can perfectly rely, knowing the intelligent and respectable character of the gentleman to whom he was indebted for this account, which in substance has already been given.

Hearing from Mr Menteath of Closeburn, that barberry hedges were to be seen at Shaws of Closeburn, possessed by Mr Anderson of Strophan, and that mildew also existed there, the author went thither, with the Reverend and esteemed Mr Andrew Yorstoun, minister; and they were informed, in absence of Mr Anderson, by his people, that ‘the wheat and oats are very liable there to regular and destructive mildews; and that another farm, contiguous to that of Shaws, is also affected by them.’

Struck with these facts, together with the suspicion in which English farmers hold the barberry, and with the observations of Sir Joseph Banks,

and other men of science, (which were not unknown to him, though he had been sceptical on the subject), he thought it right to examine the two farms of Wamphray-gate and Kirkbank, and he found barberries in the hedges of both farms, contiguous to the fields where the oat mildew exists. It had never occurred to him to examine those hedges before ; and he was not in the knowledge or the recollection of their containing plants of the barberry. He has since been told, that these hedges were planted a few years before the mildew first appeared ; and that no other hedges contain them in either parish. It is also well known, that in no other place does this regular and pernicious distemper affecting oats exist, in either parish.

Two facts appeared rather to contradict this mass of testimony. It was reported, that at Mr Irving's of Cove, barberry hedges existed, and no such thing as mildew in oats. It was also said, that the oats of crop 1810, at Wamphray-gate, were quite free of mildew, near the barberry hedges. The author went on purpose to examine these oats, with the man who had reported them quite sound, and on taking up a handful near the hedge, every stalk was evidently mildewed ; but the oats were of an early species, had been well advanced in filling and ripening, and therefore had suffered less than cold-seed or late oats used to do. This took place on the 4th September 1810. In the same year, a gentleman examined the

hedges and oats at Cove, and reported both of them free of mildew, though barberries abounded there ; but as this fact was anomalous and confounding, the author had them examined *again* in 1811. And the Reverend Mr Henry Duncan, with his brother, the Reverend J. J. Duncan, M. D. one of the ministers of Dumfries, having been so good as to inspect the oats and hedges at Cove, on the 24th September 1811, they reported, that all along the hedges the oats were clearly mildewed, and the worse, the nearer to the barberry hedge : also, that they had seen the gentleman who had examined them before, and who said he did not exactly know the mildew, and therefore could not report correctly on the subject.

Mr John Aitken, tenant of Kirkbank, sowed in another farm, Barntympan, where there is no mildew, the light oats that had grown at Kirkbank ; and the produce was a rich crop of good grain ! The author not only had this information from Mr Aitken and from his people, but he saw the crop at Barntympan, and it was excellent.

In the present year, 1811, (which has been one of a very striking character in this county for continued rains during most part of May, and the first half of June), the best lands in common tillage, particularly potatoe lands, have yielded hardly any crop, in either oats or barley, worthy of the name ; while grass lands, newly broken up from old ley, have yielded luxuriantly.

And in addition to the defects arising from the crops being thin, poor, and foul, some particular spots have exhibited mildewed oats, where such a distemper was never before seen or heard of. This has been observed above Hillside, on an open eminence, looking to the south-west, and having no such neighbour as the suspected barberry, nearer than Balgray, at about half a mile's distance. The same appearance has been observed by Mr Keay, in the parish of Johnstone; remote from Kirkbank, and not in the close vicinity of any barberry hedges. The author has found a few mildewed stalks of oats in his own fields at Kirkpatrick-juxta, where he never saw this distemper before ; and he has noticed stalks of couch-grass excessively affected with the same appearance, and close to these diseased oats. He also remarked it on some particular stalks of the fiorin (*agrostis stolonifera*) growing in the watered meadows of Major-General Dirom of Mount Annan ; all in the present year 1811, about the end of September. And, in all these instances, there was a blacker colour in the diseased parts of the plants, than is commonly observed, in the stalks of mildewed oats ; and, in the oats and grasses affected in the author's own fields, the distemper extended quite down to the ground, instead of only reaching as low as the second knot, counting from the root, which is the common case with mildewed oats.

But it ought to be mentioned also, that though partial injury has been done by this black mildew of 1811, in a few places, and in particular spots, to crops of oats, at a distance from any barberry hedges, the mischief occasioned by this malady (the black mildew) has been of little consequence. It is proper, indeed, to add, that in most years, a very partial and insignificant appearance of spots on the straw, may be observed in all quarters of the kingdom, and in all descriptions of grain, barley not excepted.

The general wheat mildew has, in different seasons, been severe in this county, as it was in others; but it is a known fact, that oats did not suffer by it.

And in the vicinity of barberry hedges, where oats are suffering by regular mildew, every season, barley has not been, in any perceptible degree, affected.

A severe mildew breaks the straw so much, that it can hardly be collected with sickles. It is considered unfit for use as fodder for cattle; and is much less valued even for litter, than sound straw.

With regard to the *causes* of this distemper in oat fields, hardly any two gentlemen agree in their opinions, in so far as the author has conversed on the subject; but it is a curious fact, that

(except near Comlongan, where it has been longest established and most extensive in its ravages), most of the gentlemen in other districts appear disposed to acquit the barberry ; and the chief reason seems to be, they cannot conceive in what manner it could produce those effects which are by others ascribed to it.

The author was at first inclined to suspect, that, by the *lime husbandry*, the soil had been too much loosened, and forced perhaps to part with its nutriment rather too rapidly ; and that, by consequence, the oats having lost their hold of the soil, (exhausted in supporting former crops, and in feeding the straw), had been stinted of nourishment, and become distempered, when approaching to maturity. This was also the opinion of Mr John Aitken, farmer at Kirkbank. It received countenance from the fate of the small field at Wamphray-gate, that had been limed on the ley ; but it was entirely subverted by these facts,—that the very next field that suffered there, had *not* been limed before breaking up, and that no such distemper appeared in many hundreds of fields, that had been long under the lime husbandry, all around and over the county.

Mr Anderson of Stroquhan (a gentleman of the first character for intelligence) is disposed to ascribe the mildew to *electrical influence*. This is the more natural, since he observed, after a night of much thunder and lightning, a field of corn all

mildewed on one side of the barberry hedge, and even the hedge affected in the same way. But it is not possible to account for local and regular mildews, following every season, in particular places, by ascribing them to a highly electrified atmosphere. And though one would naturally feel diffident, in refusing assent to the opinions of such an intelligent and experienced man, in all rural affairs ; yet, by Mr Anderson's own account of the matter, it would appear more natural to think, that since the hedge itself was affected, and all the corn on one side of it, this must have proceeded, somehow or other, from contagion carried by the wind from the diseased hedge to the corn.

Mr Stewart of Hillhead, a gentleman of equal experience and intelligence, has been inclined to ascribe the oat mildew to *frost mists*. Now it is quite certain, that by this cause a blight is really produced ; but it is the whitish coloured blight, which is denominated *albigo*, not the dark brown spotted mildew, which goes by the name of rust, or *rubigo* : and if these frost mists were the cause, it might be difficult to account for barley and potatoes escaping ; or for the mildews going regularly over particular fields, and not over others equally liable to such mists, and above all, for their not appearing till within so many years, and continuing to visit the same places ever since.

Mr Keay at Goodhope has ascribed the oat mildew to the sowing of *heated grain for seed* ;

but though such a practice would be hurtful to the crop, there is no reason to think that it would produce mildew; nor are the known facts above detailed, and the practice of the farmers liable to suffer by this malady, consistent with such an idea.

Insects have been suspected; but in the oat mildew of this county, insects have not been seen in such a way as to countenance the supposition of their being the cause of the distemper. The roots of the oat stalks examined in Wamphray, were apparently quite sound and free of insects; and none appeared on the stalk or ear. Had such insects bred in the soil, and spread the distemper, it may be asked, how could the stalk have been free, all below the second knot, and the roots quite sound and clear of insects? It may also be observed, if winged, that they would have been seen on the corn or stalks; and if without wings, that it would not have been possible for them to cross the deep ravine and stream of Wamphray water.

A very wet season has been mentioned as likely to induce distempers in corn; and the present, and many other seasons, confirm the supposition. A green or dark mould (*mucor*) is produced by damp, on many substances, even on slates or stone; and it is also bred on straw in a decayed state. The walls of buildings often discover it; beginning near the ground, and ascending. Even on roofs, it very frequently appears. Climate

has effects resembling those of a wet season ; and if the soil and climate are both unfavourable, shrubs of considerable size, as gooseberry and currant bushes, and even trees, (the oak among others), are covered with mosses, *algæ*, and other parasitical plants, in great numbers and variety ; by which they are greatly injured. What then, it may be asked, is there to hinder us from believing, that corn may be liable to be affected in a similar way ?

The partial mildew in grasses and oats observed in the present year, was excessively black,—in the words of Mr Keay, ‘as black as tar ;’ and this dark colour, in the samples observed by the author of these remarks, in his own crops, and in the grasses, did not stop at the second knot of the straw, but went down quite to the ground ; inducing a suspicion that it had begun there, and ascended the stalks. The extent of this black mildew being only in spots of land, and the colour and mode of affecting the straw differing from the brown spotted mildew, (which has not in this county depended in the least on climate or season, but has been a local and regular distemper), it would appear that there is a difference betwixt these forms of distemper, both in appearance and origin. We are obliged, in some degree, to ascribe the former to the season 1811 ; but it is not possible to ascribe the latter to any such cause.

No botanist has yet been able to discriminate

all the very numerous and excessively minute plants which nature produces. Every diversity of what is called *mould*, *mucor*, and which we perceive on many different substances, and under a great variety of appearances, must be ascribed to some difference in the microscopic vegetables of which it consists. It requires a magnifying glass of considerable power to distinguish them ; and even to ascertain the fact, that what we perceive of a colour different from the substance on which it appears, does really consist of vegetables.

In the case of the brown spotted mildew, to which in particular this paper refers, it is a *known fact*, of which any person having access to a proper magnifier may satisfy himself, that the spots on the corn consist of exceedingly small and numerous vegetables ; and botanists have ascertained these to belong to the Cryptogamia class, and the family of the Fungi, or mushrooms. The only question, therefore, is, how these plants are produced in such numbers, and conveyed on the corn, and how they operate in causing the pernicious effects of mildew ?

It is no new position, laid down in order to answer a purpose, that the brown mildew, *rubigo*, consists of small fungi, which grow and feed at the expense of the plant to which they are attached ; ripening their seeds there, which form a soiling powder. Botanists tell us, that the fungus, *acridium*, is frequently found on the leaves and

stems of the *euphorbia cyparissias*, cypress spurge, the *berberis vulgaris*, barberry, the *rhamnus catharticus*, buckthorn, and on some of the *grasses*, on *wheat* and *oats*. To argue against these known and authenticated facts, would only discover ignorance or obstinacy. But when botanists further tell us, that palliatives, or preservative means, are of no use against this distemper in vegetables, we must be allowed to hesitate, before we assent.

When the air is loaded with the winged seeds of thistles, ragwort, and other pernicious weeds, the farmer has no defensive means to prevent them from intruding into his fallows. But, certainly, if thistles and ragweed were cut down, or pulled up before seeding, the air would be either clear of these winged seeds, or at least it would contain a less number of them.

The wheat mildews which affect whole counties, or extend almost over the kingdom, appear to be occasioned by causes over which mankind possess no controul. But the local brown mildew in oats, which in general, if not always, associates with the barberry, and appears not at a distance from it, even in seasons when the wheat mildew generally prevails, cannot be considered as arising from the same cause. There seems to be either a difference in the parasitical plants not hitherto ascertained; or in the sources and modes of conveyance of these plants on the grain; or, at least, in the comparative susceptibility of contagion in wheat and in oats.

It is a fact that may lead to curious investigation, that though the seasons of wheat mildew do not in the least affect the oats of this county in general, yet the same local mildew, associating with the barberry, and never failing to injure oats, is equally pernicious to wheat also !

The President of the Royal Society has rescued the important question of mildew from a considerable portion of the uncertainty that naturally hangs on it. The short account of this distemper which he published in 1806, is accompanied with drawings of the seeds of the fungus which occasions the mischief, and of the pores in the stalks of corn by which it finds admittance ; together with the parasitical plant in every stage of its growth, till it forms and sheds its destructive seeds. We are also referred, for an illustration of the mode in which these minute seeds may be disseminated in the air, to the ripe puff ball, (*lycoperdon stellatum*), which is a fungus of incomparably larger dimensions than the mildew fungus ; and yet, whose black seeds are scarcely heavier than air, and float over a large extent of ground, when the puff ball is opened. One may conceive how much wider, and more insensibly, the seeds of a fungus (ten thousand times less than the *lycoperdon stellatum*, and the very plant of which is microscopic), may be disseminated in the air, and find access to the pores of growing vegetables.

That some vegetables admit this fungus, and

are greatly injured by it, while others do not harbour it, or do not suffer in consequence, is a known fact. Sir Joseph Banks has even assigned as one reason for this, in the case of barley, that the sheath protects the most part of the straw. Still, there must be other reasons; for the fungus might hurt the plant in general, by fastening itself in the sheath; or it might affect with distemper the ear, and that part of the straw which has no cover. The fact is known, and it is of great importance, that barley suffers either very little, or not at all, from the mildews which are fatal to wheat and oats. Whether the texture of the straw resists this malady, or the qualities of the plant, is not known.

Fontana and *Sowerby* had endeavoured to attract the notice of the public to the mildew fungi; and *Kirby* had followed them in the same important track of investigation. The President of the Royal Society has given publicity and sanction to the discoveries of these authors. Attention and correct observation appear to be the objects that he wishes to promote. If these were generally and fairly given, without undue acquiescence, or illiberal prejudice, who can pretend to say that good might not be done, to an extent that no man can at present ascertain?

The facts recorded on the subject of mildew in the queries disseminated by Sir John Sinclair, and in the answers which he received, may come to be of great use hereafter, when a larger body

of information is procured, by the observations of farmers, in relation to such facts and appearances as come under their view; and by the scientific and exact statements of botanists, who employ good instruments, and bestow a sufficient portion of time and attention.

The observations of T. A. Knight, Esq. annexed to the second edition of the above mentioned pamphlet, published by Sir Joseph Banks, record as facts,—that a row of wheat, sowed in his garden round a barberry bush, appeared to grow in perfect health till the beginning of July; began then to appear diseased, and, in the course of a single week, was covered with mildew spots; that the same sort of wheat, sown at a distance, continued quite free of distemper; that a branch of the barberry, having diseased fruit on it, was carried to this wheat, was moistened with water, and used to brush the wheat, and that in ten days the wheat plants were covered with distemper; that mildewed stalks rubbed on others that were sound, without water, did not communicate any disease; but that, on sprinkling water also on them, in ten days they were mildewed; and that, after all these experiments, he sprinkled water alone, plentifully, on the plants that appeared to remain sound, and found that, in the same time, even these exhibited signs of distemper.

Mr Knight seems to be of opinion, that mere water, applied as he did, very cold, in the afternoon of a warm and bright day, while the ground

was very dry, (by a great degree of absorption, and a considerable change of temperature), may have occasioned disease ; but whether the seeds of the mildew (fungus) were carried into the pores by the water, or existed there before, he does not pretend to decide. It appears, however, from the facts which he records, that infection does not operate without moisture ; and it seems highly probable that from the branch of the barberry, having diseased fruit, with which he brushed some of the wheat, producing distemper, a portion of the very minute seeds could not fail to float over the rest of the patch of wheat sown there ; and, when moisture was applied, they would vegetate of course.

It is recorded as a fact by Sir Joseph Banks, that in the year 1804, the wheat of England was very severely mildewed ; that the lowest land in all cases fared the worst ; but that, when exposed to the immediate influence of *sea winds*, they did not suffer so much. Mr Kerr of Ayton's answers to Sir John Sinclair's queries, also establish that the near neighbourhood of the sea appeared to have a beneficial effect in preventing or lessening the distemper.

Yet Mr Kerr very properly records another fact, that ' six or seven years before the period ' when he wrote those answers, many fields of ' oats, within two or three miles of the sea, were ' exceedingly injured, a little before harvest, in ' consequence of a thick and stinking mist or fog,

'which rolled in from the sea for several days.
'The small pedicles of the florets, or the ramifications of the heads, became attacked by a fine
'black powder; which, however, was not microscopically examined, but has been said by others to have consisted of myriads of insects of
'the aphis tribe, which had settled on the grain.
'In consequence of this affection, the pedicles
'became exceedingly tender and brittle; insomuch that, in handling during the reaping and
'binding, and other harvest operations, great
'quantities broke through at these small necks,
'and a considerable loss of grain was sustained,
'perhaps equal to from 6 to 18 bushels per acre.'||
'Nothing of the kind took place in 1808; and
'the barley and oat crops seem to have been less
'subject, considerably, than usual, to a species of
'smut, to which they are often liable in a small
'degree.' Yet the severe and most destructive
mildew of 1808, in the wheat crops, as Mr Kerr
observes, 'began to make its appearance imme-
diately subsequent to a heavy fog or mist, rising
'as it were out of the ground, about the 4th to
'the 10th July, and which was followed for sev-
eral weeks by much misty and rainy weather, at-

|| This took place in the end of August and beginning of September 1800. The disease was certainly occasioned by aphides, which, adhering to the slender foot-stalks close to the grains of oats, so weakened them, probably by wounding them, in intercepting the juices flowing up through them to nourish the grains, that the grains dropped off in the manner above mentioned.

'tended by considerable heat, and little wind:'—weather exactly adapted to the vegetation of these fungi.

If any thing were wanting, to prove that the general mildew of wheat in particular seasons, and the black mildew that sometimes affects oats, are not the same distemper, nor occasioned by the same cause, these facts would be sufficient.

A similar and unusually thick stinking fog (not from the sea, which is remote, but in other respects as Mr Kerr describes it) was experienced in particular parts of Dumfries-shire, in the present year 1811, in places considerably inland; about a fortnight before the black mildew was discovered in particular spots of oats. But it ought to be observed, that such a fog is not unfrequent, even in years when there is nothing of this distemper worthy of notice.

If oats and grasses affected with the black mildew were microscopically examined, and the difference ascertained, betwixt this distemper and the common wheat mildew, it would be, so far, of importance.

Fontana maintains, that the yellow and the dark brown mildew are occasioned by different species of fungi. It is very probable that this is the fact; and also, that the black mildew of oats and grasses differs from both.

In this county, the local mildew of oats, which also affects wheat within a certain extent of ground, is of the dark brown variety; and not only do Mr Knight's experiments clearly prove,

that it can be communicated at pleasure to sound wheat, by a barberry bush carrying diseased fruit, but the uniform report of English farmers, who have observed that barberries communicate mildew, confirms the report of Mr Knight; and the same attestation has been given to it by every fact that has been ascertained in this county on that subject.

No rational mind can resist the accumulated evidence of so many facts and authorities, even though the manner in which the contagion is conveyed were totally unknown. But when it is positively ascertained, as has long since been done, that the barberry is itself liable to a similar disorder, and that fungi breed in great numbers, and shed their seeds on it, there appears to be no difficulty in conceiving how these microscopic seeds may be conveyed by the wind into the adjoining corn, and may grow and feed at its expense, injuring its texture, depriving it of nutriment, and producing mildew.

If the weather happen to be moist and warm, the seeds will, of course, adhere the more readily, and vegetate with more effect.

There is no evidence of any harm being done in this county by the local oat mildew, till near the period when that grain usually begins to ripen. It must therefore be supposed, that at that time the seeds of the fungus have been brought to maturity, have been disseminated, and have begun to grow.

Contagion may be very naturally supposed to

spread from *any* plants affected with this distemper, and bearing fungi with ripe seed. But in point of fact, there is not a case known here, of contagion passing from affected corn in one field to sound corn in another. If the corn be not affected until it be ripe, the danger is over; and if there be contagion within reach of two contiguous fields, they suffer at the same time,—but the ripest grain suffers least.

Supposing that every affected plant should, at one time or other, become a vehicle of contagion, still there is a difference betwixt an *herb*, which dies down to the root if not removed, and a *shrub*, which remains. It also deserves attention, that a *hedge*, planted in the midst of corn fields, raised on a small bank or eminence, and left to remain there, if it be liable to this distemper, must not only tend to perpetuate the evil, but to spread and disseminate the contagion to the widest extent.

The idea of resemblance betwixt mildewed corn and scabbed sheep, suggested by an eminent farmer and writer on agriculture, may be so far adopted as to authorise the following question, viz. What would the public think of a store farmer who should wilfully retain, year after year, in the midst of his flock, sheep affected with that contagious distemper? And if this question be allowed, a similar question occurs on the subject of the barberry mildew:—What must we think of such farmers as continue to leave barberry hedges, covered as they often and naturally are,

with the mildew fungus, and ready to disseminate the poisonous fruit of it among the corn?

Let such as will take the trouble of perusing the facts and observations here collected, mention if they know any thing that can fairly contradict them. If they can, as the author wishes only to come at the truth, he will most readily allow every proper degree of weight to it; and as no person can entertain stronger doubts than he once did on the subject, he trusts that such a confession will have some weight in moving others to examine for themselves. The appearance of the fungi on the barberry plant, is not the same with that of the fungi growing on mildewed corn; but this difference of appearance may be caused by the very great difference of the plants on which they grow; and the fact of their being communicated from the one to the other, may remain out of the reach of doubt.

The local mildew in oats is attended with certain loss, year after year, in the lands which are subject to it. Perhaps the amount of this annual damage would not be overrated at one thousand pounds, within the county of Dumfries. Lord Mansfield's factor has cut the hedges about Comlongon Castle nearly to the ground; Mr John Church has eradicated the barberries on his possession. If other gentlemen would try the same method, it would soon and clearly appear how far this malady is capable of being diminished or got rid of altogether.

A degree of confusion occurs in consequence of botanists and farmers using different *names* for the same distemper. *Blight* is used as a word of the same import with *mildew* and *rust*. Perhaps it would be better to confine the term *blight* to such cases as correspond with *albigo*, the whitish coloured abortive appearance that corn assumes when affected by frost mists, or in some other way deprived of nourishment; leaving the *mildew* or the *rust* to correspond with *rubigo*, and, when possible, distinguishing betwixt the yellow, the brown, and the black mildew; betwixt that which is local, and that which is general.

With respect to *abortion*, which Mr Brown of Markle, Mr Kerr of Ayton, and other eminent wheat farmers distinguish from the *mildew*, it may be observed, that, by others, it is frequently confounded, at least in estimating the damages done by distempers in wheat. But when the flowers are injured by the destruction of the anthers and pollen contained in them, or when the organs of generation are rendered incapable of performing their office, by the ungenial state of the atmosphere, or by unfavourable circumstances as to the health of the plants, from whatever cause rising, part of the cups must, of course, be empty; as, when the corn happens to be laid down by wind and rain, and the stalks crushed as well as laid, a deficiency of grain must inevitably follow;

which is occasioned by mechanical impediments to the processes of filling and maturation.

After all, it is not even unlikely, and far less incredible, that the same distemper may be induced by different causes. Other plants may contribute, in some degree, with the barberry, to produce local mildews in oats. The rot in sheep is either brought on by overstocking, by wet pastures, by water meadows irrigated in summer, or by unhealthy seasons. Various causes are assigned for one and the same distemper in the human body. A great mass of additional facts are wanted, in order to arrive at clear and positive knowledge of the subject, if that knowledge can ever be attained.

In the mean time, what is already discovered may be of considerable importance to mankind, in the hands of reflecting and intelligent men.

It is not a little remarkable, that a more enlarged view of the facts above mentioned, and of others now before the public, than is commonly taken, seems to reconcile all the opinions that have yet been emitted worthy of notice, and supported by any of these facts.

The atmosphere seems to be the medium through which mildew is communicated to corn; and moist, warm, calm weather, with fogs, accelerate its progress, by promoting the adhesion and growth of the destructive plants, which are known for certain to be the immediate cause of

this distemper. Weather of that character, favourable to vegetation, promotes very rapidly the growth of the fungi, and hastens the destruction of the debilitated corn.

The *general result* of what is yet known on the subject, appears to be as follows.

Wheat, of all kinds of grain, is most liable to mildews, whether general or local. The sea-fog, however, that has been thought the cause of a black distemper like mildew in oats, does not seem to be hurtful to wheat. A ground rook, or fog, is ominous of mildew about the ripening season. Open situation and sea-air are thought favourable, as lessening the degree and extent of general wheat mildew. Woolly-eared wheats are most severely injured. American seed-wheat is often grievously affected in Dumfries-shire, in seasons when that which has been naturalized in the county or the kingdom suffers no injury. Does this arise from the texture of the straw of the American wheat being more adapted to the adhesion of the seeds of the fungi, or can the seeds be supposed to be attached to the grain when sown, and, like those of the balls of smut, be taken into the circulation of the juices of the new plants? Thin-chaffed wheats are less hurt by mildew than others, and sometimes the spring wheat escapes better; but creeping wheat suffers least of any variety of this grain; and refuse salt or sea-ware are thought the safest manure.

Oats are not injured by the general and very destructive wheat mildews of the worst years; but oats and wheat are both liable equally to that local and brown mildew which appears in the vicinity of barberries, year after year, without respect to soil or season. Oats are also, in common with some grasses, and even hedges of thorn, liable to the black mildew that seems to be connected with wet seasons and stinking fogs. Late ripening oats, equally near to barberry hedges, suffer most by the local mildew, which extends as far, in some years, as a quarter of a mile at least, and sometimes more, from the diseased and infecting hedges; and early ripening oats escape with least injury.

Barley is not liable to be sensibly hurt, either by the general wheat, or the local wheat and oat mildews; a fact, of exceeding great importance to be remembered.

Peas, in the county of Dumfries, have, once or twice, in the last sixteen years, been attacked by green flies (*aphides*) in the blossom, and have carried no fruit that year. Early garden and late field peas have often been affected with blight, *albigo*, in consequence of early or late frosts; but they do not suffer by either the general wheat mildew, or by the local distemper affecting wheat and oats.

Neither have sown grasses or beans, potatoes or turnips, ever been observed to suffer by this malady. Though turnips, in some districts, are affected by a distemper which goes under the

name of mildew. It arises from want of moisture. The bulbs cease to swell, and the leaves are covered with a dead whitish substance, resembling, to the naked eye, a thin cobweb. It generally appears about the end of August, and beginning of September.

With regard to the general *wheat* mildews, though the origin and progress of them be not within the controul of mankind, there is room for much and important consideration in selecting the seed; and some advantage may be attained by observing the time to sow, and the most favourable situations. Even the manure enters into view. The symptoms of distemper—the time to cut down, if really affected, (which ought not to be put off as in the case of sound grain)—the most proper use to be made of the produce, which experience will best ascertain;—and, above all, the sound policy of not sowing too extensively in wheat under so much risk.

In relation to the local mildew of wheat and oats, the only remedy that can be suggested is obvious and easy;—to extirpate the diseased hedges that produce it, or, at least, extend and perpetuate the distemper. If this be not in the farmer's power, let him sow early ripening grain, and let him cultivate barley and green crops.

October, 1811.

POSTSCRIPT, 21st SEPTEMBER, 1814.

SINCE the preceding Essay was written, the following facts have been communicated to the author, viz.

That some of the governments in Germany have ordered experiments to ascertain how far the local mildew in wheat is connected with barberry; that the result has been, to establish this connexion; that, for more certainty, these experiments were repeated with the same result; and that an order followed for extirpating the barberry; in which the public sentiment agreed. This communication was obligingly made by the Right Honourable Sir JOSEPH BANKS, President of the Royal Society of London.

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Authentic information from the respectable ministers of Dalry and Loudon, in the county of Ayr, has also communicated to the Author as facts—That on the lands of Colonel Boyle, and on the estate of Loudon, there had existed, for many years, a pernicious local mildew, which had lately been removed; and that, for three suc-

cessive years, these lands were free from it. Inquiries were made into the mode of prevention, which discovered, that it consisted simply in extirpating the barberry.

In winter last, 18 $\frac{1}{2}$, Mr Stewart, factor for the Earl of Hopetoun, and for Dr Rogerson of Wamphray, gave orders to extirpate the barberry on the lands of Kirkbank and those of Newhall; and by reports made within these last two days, the author of the preceding Essay has been given to understand, that there is no sign of mildew in either of these farms.

These facts appear to be decisive of the question, if any thing was required in addition to the mass of testimony obtained from other sources. It is now obvious, that no plants of the barberry should be suffered to remain in the vicinity of lands intended for cultivation under crops of wheat or oats; and that landholders have an interest in employing their authority for the complete extirpation of a plant so pernicious.

ESSAY

ON THE

PRINCIPAL RECENT IMPROVEMENTS IN AGRICULTURE IN
SCOTLAND, SO FAR AS CONNECTED WITH LANDS COMMONLY IN TILLAGE;—THE NATURE OF THESE IMPROVEMENTS, THEIR ORIGIN, AND HOW FAR THEY MAY BE EXTENDED;—THE CLIMATE AND SOIL BEST ADAPTED FOR THEM, AND THE MOST PROPER MODES OF INTRODUCING THEM INTO NEW SITUATIONS.'

By the Rev. WILLIAM SINGERS, D. D.

THE commencement of those measures which prepared for the introduction of improvements on the great scale into Scotland, may be dated from the union of the kingdoms in 1707. It is true, indeed, and well known, that, prior to this period, the Legislature of the country had laboured to recommend improvements in Scotland; as their acts on the subject of planting, enclosing, and others connected with improvements, clearly prove. Some of these are of a very ancient date; and

some of them remain in force at the present day, being confessedly of such an enlightened character as to merit attention and respect in other kingdoms.

But after the union with England, it became a common object in both kingdoms to extend improvements over the whole. The local jealousy that had obstructed this measure was at an end. Opening markets and commerce, with extending capital and credit, furnished encouragement, and supplied the necessary means of improving. The Legislature of the United Kingdom called forth attention to the state of the country ; and, by a small grant of money, intended for the benefit of the woollen manufactures and fisheries, and also for other improvements, awakened the notice of those who were most interested in improving the soil of Scotland. In short, though the 15th article of the Treaty of Union provided only 2000*l.* a year for the above purposes, it was followed by very happy consequences. The spirit of a respectable association which was formed in 1723, under the designation of ‘ The Honourable the ‘ Society of Improvers, in Scotland, in the know- ‘ ledge of Agriculture,’ was instrumental in promoting the views of the Legislature ; and the special act for encouraging the fisheries, manufactures and improvements, together with the constitution of the respectable Board established in 1727 for these purposes, must be considered as evidences of an improving spirit liberally formed, and leading to extend its happy influence.

Publicly stimulated and encouraged in this manner, enjoying liberal intercourse with England, and possessing the same privileges in trade, besides the powerful support and useful example of that more advanced and opulent country, the people of Scotland had made some progress by the year 1743 ; and the practice of draining, enclosing and summer-fallowing, with the culture of hemp, flax, rape, turnip, and grass-seeds, had been introduced ; together with the planting of cabbages after the plough, and of potatoes by it, in the fields. It was computed, that, about this period, there was corn raised on lands formerly waste, equal to one sixth of the former total produce of Scotland. *

Still, the views and practice of Scottish farmers, in general, continued rather incorrect and confined. Of the principles of husbandry they had not, in general, a clear understanding ; and (of course) they had not a correct system of culture and rotations. Their means were also very defective ; neither their teams, nor their implements, nor capital, being adequate to the purposes of liberal and effective agriculture. Manures were not then either so plentiful, or the nature and use of them so well understood as they are at present. Encouragement was often wanting in respect of leases and markets ; and it seldom happened that proper accommodations were afforded in buildings and enclosures.

* *Transactions of the Society of Improvers,*

Even after these defects and obstacles began in some degree to give way to a spirit of more liberal improvement, not unfrequent (and sometimes very perplexing) errors occasionally impeded and discouraged that spirit. A landholder's meditated improvements were sometimes too early for the state of the country ; he was not happy in his tenants ; the correct mode of executing improvements was mistaken ; others were attempted in wrong order of succession ; and, one way or other, they often fell short of expectation, and involved their authors in disappointment and loss.

There is a natural order and association of improvements in agriculture. To lime wet lands before they have been drained, or to sow the finer sorts of grain or small seeds on lands which have not been duly prepared by tillage and manure—to introduce turnips, or sown grasses, or wheat, on lands which are open to perpetual depredation—or to purchase the more valuable and delicate breeds of animals for coarse and unsuitable soils, can be attended eventually with nothing but failure.

It happens, also, that one improvement is not unfrequently concealed within another, though not perhaps obvious at first view. The great and universal abolition of the distinction betwixt infield and outfield lands in Scotland, has been the legitimate consequence of the lime husbandry. This not only supplied a new manure, highly enrich-

ing to all soils on which it was new ; but, by rendering barren soils fertile, and soils formerly in culture more productive, both in grass and corn, it supplied the means of accumulating more farm-yard manures ; and the whole of the lands of a farm were thus brought within the range of improvement. In the same way, it may be observed, that improved rotations are naturally concealed within improved systems of enclosure.

Every one would wish that it were possible to trace the introduction of improvements to those individuals who had the merit of their discovery, or at least of their introduction ; but this does not seem to be either practicable or necessary. Many of the recent improvements in Scotland are not inventions of this country ; and many persons may have contributed simultaneously to introduce them. The efforts of some individuals have been so enlightened and liberal, as to be recorded in the annals and the memory of the country.

After all, if improvements were to be the business only of men of property, while the professional farmer wants the skill, the means, or the proper motives, their progress must be slow. Notwithstanding what was done by the Legislature to promote them, together with the zeal and spirit of distinguished individuals,* it may be thought

* The Duke of Athol, and other Scottish nobles and gentlemen in 1723, and for years after; the Earl of Ilay; the Earls of Stair and Hopetoun; Mr Cockburn of Ormiston, Mr Hope of Rankieillor, Lord Kaimes, Mr Craik of Arbigland, &c.

surprising that, as far down as the year 1776, improvements were in a very backward state, even in the southern counties of Dumfries and Wigton, and in the stewartry of Kirkcudbright.

Experience was, in former times, almost the sole instructor of the farmer. It was perhaps safe; but how narrow, expensive, and defective! A more liberal spirit of inquiry has been diffused of late among this class. Eminent practical farmers have appeared on the field of improvement; and landholders have accommodated such men with suitable buildings, fences, and leases. Farmers of inferior note have, by these means, been encouraged and roused to exertion, while the profession of a farmer has risen in public estimation. Capital, talents, and active zeal, have thus been drawn into the field of agriculture; and instead of exhibiting the former style (which was commonly mean and depressing), this valuable art displays rich variety and progressive improvement; while Science diffuses her lights over it, and the various talents and means of tenants are honourably called forth, and meet with suitable encouragement and reward.

In order to remove obstructions to improvement (which are partly of a local character, and partly either moral or political), the cooperating exertions of landholder and farmer are not entirely sufficient. Associations have, of late, been of great use in this respect, both in promoting useful knowledge, and in stimulating to correct prac-

tice. The labours of the Highland Society of Scotland, since its establishment in 1785, and those of the General Board of Agriculture since 1793, are well known and duly appreciated. Local or district associations have been eminently useful in the same field of exertion. The best practice, and most prominent errors or defects in every county of Great Britain, are now likely to be soon understood throughout the United Kingdom.

Monied or landed gentlemen, by investing part of their stock in improvements, may be of eminent service to the public, even though these operations may have in view only the gratification of an elegant taste, or the prospect of returns which are distant. But the following statement is confined to such improvements as make suitable returns to the actual farmer, sufficiently ample and early to enable him to pay rent, and proceed in his operations, and, at the same time, substantially advantageous to the landholder and the public.

In wet lands, manures do not operate, labour cannot be gone through to good purpose, nor can suitable returns be expected. If a luxuriant crop should, by any peculiarity of season or circumstances, be raised on wet lands, it ripens very ill and very unequally; and it can hardly be well

harvested, nor is the quality of it good, when secured. Add to all these considerations, the following, viz. that hedge-thorns do not grow on wet lands till they are properly drained; that stone walls do not stand well on soils unequally solid on account of water; and that no real improvement is practicable (not even by irrigation) on wet lands, while in the climate of Scotland, moisture is rather in excess. Even the clearing away of roots of trees, stones, or other obstructions, is hardly practicable on lands drenched with water. Therefore it must appear, that of all substantial improvements, the first is

Draining.

Draining. Some general ideas have always existed, which accord with the above remarks: But more correct and precise views have been, of late years, entertained. These have led, 1st, to the fence ditch, operating also as a drain; 2^d, to the use of the covered drain; and, 3^d, to the small drain, which is common in sheep walks. This last has been extensively used in some of the border districts, to very good purpose; but it is with the two former, chiefly, that lands in tillage are connected.

The *Fence Ditch*, to operate as a drain also, was first in regular use in the Carse, where such a drain was of essential service to carry off the surface water by the several ridge furrows, and also in order to cut off springs and bursts of wa-

ter, or to conduct rivulets descending from the higher lands adjacent. A ditch in these corses was found preferable to any hedge, as it neither obstructed sun and air, nor afforded harbour to birds. In peat-mosses, and particularly in order to separate these from the contiguous lands, the fence-ditch and drain as a fence, was found equally suitable as in the Corses. It has been extended, with great advantage, through clay soils and wet muirs ; and over mossy districts, where it has tended at one time to the improvement both of soil and climate. The materials removed from the ditch are used, either in forming a parallel bank of earth to be planted or palisaded, for additional security to the fence, or they are carried away to fill up hollow places in uneven surfaces, or (if wanted, and of proper quality for manure) they are made up into composts. A wet soil, previously unfit for thorns, commonly becomes very genial for these plants, when suitably drained. In order to serve as an efficient fencé against cattle, a ditch must be six feet wide at the surface, measuring horizontally ; three feet deep vertically measured ; and about two feet wide at bottom ;—the sides cut quite straight, without curvature. When the accessory power of banks and hedges, palings or walls, is added, the size of the ditch may be less in proportion to that security. Wet clayey soils, that slope not so rapidly as to prevent them from being tilled, should have

their horizontal fence-ditches declining only a little from the level, that all the water possible to be taken up in them may be intercepted, and flow gently away; and their other ditches, which run up and down the declivity, are made sloping, in such a way as to lean towards the right in their ascent, that ridges may be laid out parallel to these, and the plough may clear freely in going upwards. When the slope is great, the horizontal ditches ought to be laid out at shorter distances from each other than in flat lands, in order to intercept the water more safely and perfectly, and also to fatigue the ploughing teams less severely in their ascent, by shortening their journey, and giving them relief in the frequent turnings.

The *Covered Drain* is preferred when it lies in the way of the plough, or passes through lawns or pastures, or through garden or other cultivated soils. It is of three descriptions:—the common covered drain, that of the celebrated Elkington, and the narrow Essex hollow drain. The *common drain* is generally cut betwixt the wet soils and the dry, of various depths and widths, as circumstances require. The narrower it can be made (so as to prevent the sides from rushing in, till it is filled up), the less expense it causes. This drain is filled with small clean stones, or other open materials, for about the depth of a foot or more at the bottom, so as that, among these materials, the spring water may start and ooze away: turf, broom, heath or straw, is laid over the

stones, and the soil above these materials ought to be more than a foot in depth, in order that while the drain continually operates, the plough and other implements of tillage may not be obstructed. This drain is now very common and very useful. It answers for intercepting spring water, when it rises at the crop of impervious strata, and injures the surface mould.

Elkington's Drain is commonly covered ; but it is often built up on both sides, with a cover over the building ; the water passing within it, and holes opened along the bottom, in order to make way for subterraneous waters, which by the pressure above them are forced up all along the line of this drain, and carried away in it. This drain requires boring instruments, building and covering materials, and a proper degree of skill to plan out and execute the work. It is not yet so common in Scotland as it is likely that it will be.

In Essex, where the soil is valuable, the climate and situation favourable, and labourers and implements at command, a *hollow drain* is laid under the soil, as narrow as it can possibly be made, and others placed nearly parallel and in great numbers, being only a small distance asunder. This mode of draining has not been extensively in use in Scotland ; nor is it likely to become very common there.

As soon as lands are laid thoroughly dry, it becomes necessary and practicable to clear them of stones, roots, and other obstructions. No cultivation can take place to advantage till this be effected: And therefore the second improvement, in the proper order of succession, is:

The Clearing away of Obstructions.

removing
Ob-
structions.

When land is underlaid with solid rocks, in many parts approaching to, or appearing above the surface, tillage may be considered as out of the question. The proper culture of such lands appears to consist either in planting them, or in improving the pasture which they produce. But when brushwood of little or no value, or when brambles, thorns, whins, or broom, occupy soils, which may be converted into tillage lands, or when they are beset with what are called earth-fast, or land stones, interrupting the plough and harrows, and frequently destructive of these implements, hurtful to the teams, and obstacles to deep and regular culture,—the improvement is very great which is effected by their extirpation.

Experienced hands are capable of doing a great deal of work in this matter. In order to get out the broom, whins, and smaller sorts of brush, including brambles and sloes, a very light pick-axe

is employed, having one end narrow, pointed with steel, and the other with an edge of the same metal, at right angles to the line of the iron part. Whins and broom are then cut out by the tap-roots when in blossom, at which period the operation is fatal to these plants. For larger sorts of brushwood, pick-axes of a much heavier sort are used, having a cutting edge at each extremity, the one at right angles to the iron, and the other in the same plane with it; and it is usual for two men to work together in this business, having each of them a heavy pick-axe, and betwixt them a strong wooden lever, and an iron crow.

In extirpating land stones, the first thing requisite is to mark the situation of every one of them that appears when the land is opened up. In many cases, a common pick-axe and iron crow are then sufficient for clearing them around the base, and raising them out of their beds. In other cases, the aid of two or three men with strong levers is requisite. Some require blasting with gunpowder. The stones become valuable for building walls or fences, and often pay most of the charges of taking them out; particularly if the operation is carried through before enclosing.

With regard to the small round stones which require to be gathered off the soil, being picked up in dry weather, and laid aside in a convenient situation, they become very useful in filling up covered drains.

An intelligent improver always keeps in view

to accomplish as many useful designs as possible, or to prepare materials for them, by one operation,

The soil being well drained and cleared of obstructions, it is the proper time for the most important improvement of modern times, viz,

The application of Calcareous Manures.

The use
lcareous
res.

The use of these was known, in some degree, even in remote times: but that extensive and judicious application of them, which has taken place in Scotland, is of modern date. It is quite well remembered in Dumfries-shire, when very little marl or lime was applied to land, and when extensive tracts now in corn and green crops, or in good grass, were barren muir; while the soils that now carry barley, white oats, and wheat, were judged incapable of producing any thing except the grey-awned oat. In that county there are now about 140,000 acres of land under the influence of calcareous manure; and the inhabitants, though very much increased in point of number, and much better fed, instead of importing grain from Tiviotdale and Cumberland, export large quantities to other counties.

It is by the use of calcareous manures, chiefly, that farmers have been enabled, in all parts of Scotland, to abolish the former wretched system

of outfield, and to bring their whole possessions of land under proper manures and rotations. They are slow in operating ; but in good management they produce lasting effects, promoting the decomposition of inert vegetable matter in the turf or soil, and, by so doing, rendering strong ob-durate land soft and unctuous; opening stiff soils, and giving such as are too loose by an over proportion of sand, some degree of tenacity ; neutralizing acid substances unfriendly to vegetation; sometimes destroying pernicious insects, and converting them into manure. Thus, producing a large increase of grain and green crops, a corresponding addition to the disposeable manure of the farm yard, and the melioration of pastures for live-stock.

When these manures were introduced into common use, marl was preferred in suitable situations, not remote from the pits, being ready for use as soon as it was dug out. It was afterwards found, that (though lime requires to be broken in the stone, calcined into shells, and then reduced to powder by water, yet) lime was preferable, from the lightness of the shells for carriage, and the superior efficacy and earlier returns obtained from equal quantities of it. Of course, a demand arising for lime, quarries were opened, and kilns erected ; and at present the quantity of lime used for manure is augmented immensely, while marl is less extensively carried. The use of both has almost entirely superseded the water-tathing sys-

tem, or that mode of irrigation which was practised in order to prepare grass lands for corn.

Lime is always carried in shells, being greatly more light than when reduced into powder, and occupying not half the bulk. It is reduced to powder either by water applied soon after the shells have been laid down, or more slowly, by covering these on the land with mould : And the sooner it is applied to the soil afterwards,—the more equally it can be spread,—the more ground it covers,—it mixes the more intimately with the soil, and it makes returns the earlier.

On fallows, (when this manure is well harrowed into the land), the returns from lime are expeditious. On leys, newly formed of lands lately under cultivation, it answers to enrich the herbage. From old leys, full of inert vegetable matter, the returns of lime have often been remarkable, when it was the first application, and when it was laid on so long before breaking up for corn as to sink down well into the turf, get firm hold of it, and act on it, facilitating its reduction. The first application of calcareous matter is most effective on all soils ; and it must not be very frequently repeated on any ; unless, by laying out in pasture, or by large applications of putrescent manure, there be a sufficient quantity of unreduced vegetable matter, on which the lime, by its known septic power, may act. Less dung answers the farmer's purpose, when there is lime also in the soil ; because the lime operates

on the unreduced part of the dung, and hastens its decomposition. If earth were perfectly dry, lime would not have these effects ; neither does it operate in lands drenched with water. It is in soils possessing a due degree of moisture, (not more than what is requisite for the purposes of vegetation), that lime operates on the inert vegetable matter contained in those soils, and hastens its decomposition.

An overdose of any sort of manure does harm. Dung or lime in too great quantities, render the soil too open to retain plants ; or these become too luxuriant, and are either thrown out by the heaving of the land ; or grow so late and rank, as never to mature their seeds ; or to lodge and rot.

A barren muir, which previously produced nothing but stunted heath, when dressed with lime, and afterwards yields sweet grass, or good corn, excites particular notice. In such a soil there is often much inert vegetable matter for the lime to act on : but if it be much exhausted by over cropping, this vegetable matter fails, and a second application of lime does not produce great effects. The soil ought to be well manured with dung, and laid out in ley, for pasture, that vegetable matter may again accumulate in it. Afterwards, the application of lime again succeeds, though perhaps in a less degree.

Marl has effects very similar ; but as it contains less calcareous matter in equal bulk, a great

er quantity is required. On light soils, however, it is ultimately even more beneficial, on account of its containing clay; and (shell marl) having also a portion of animal matter; by which means, taken together, the marl adds first to the staple, and next to the fertility of the soil. Shelly sand, though less rich than pure shell marl, is admirably adapted for mossy soils, which it both enriches and consolidates. What is called stone marl, requires too much time and labour to be generally recommended.

Not only is the texture of soils improved by the judicious use of calcareous manures, and large additions made to their fertility, but soils are thereby prepared for almost all the more valuable crops of grain and herbage. The barren muir, the old croft lands, the neglected outfields, and the poor fogged or moss-covered old leys, are all enriched by their first application. It is indeed an object of the first magnitude, to extend the legitimate use of calcareous manures over all parts of the kingdom, where the soil has not been previously sufficiently impregnated with them, either by art or nature.

After the use of calcareous manures, it has been everywhere found, that the land has thus been prepared for what has turned out a fourth, and most valuable improvement, viz.

Early and Superior Varieties of Corn.

The poor grey-awned oat (*avena fatua*) was perhaps most suitable for the neglected and wretched outfields, under the old system of Scottish husbandry. Rich and full varieties would hardly have succeeded even in the croft lands. By calcareous manures (applied after draining, and clearing it of obstructions to aration), the farmer was enabled to enrich his croft lands, and to bestow manure on his outfields. It was then found to be quite an easy matter for him to raise white oats where only the grey oat formerly prospered ; and early oats and barley grew in lands that formerly would not produce bear, or big. Improving views farther led to the selection of suitable varieties of corn, according to the soil and the climate ; and oats, barley, and wheat, were introduced with success, of all the different sorts now cultivated.

In cold soils, and high situations, the culture of early oats was an improvement of great importance ; the farmers being thereby enabled, in such unfavourable circumstances, to raise crops of rich corn, on the ripening of which they could with moral certainty calculate.

The wheat of Scotland now forms a valuable portion of its produce ; meeting the increasing demand within that country, and from some districts affording a supply to the more populous sister kingdom of England.

The actual extent of improvement already made, in these respects, is of great magnitude and value ; and it is also mostly of recent date. A great deal yet remains to be done; and it offers pleasing resources for the country. Wheat may be raised in proper soils and situations in most of the lower districts of Scotland ; and either barley or bear, with suitable varieties of early oats, in lands properly manured and cultivated, in most other parts of that country.

After the soil has been manured and prepared for the richer sorts and kinds of grain, it is then fitted for suitable rotations. But these are not easily arranged, nor can rich crops be sufficiently protected, without

March Fences and Enclosures.

arch
, and
ures.

Open lands are liable to some of those disadvantages which have reduced the value of lands held in common. Sown grasses, turnips, wheat, and other crops, requiring to be protected from live-stock in winter, cannot be cultivated successfully without fences : and lands which are prepared for such crops, are of adequate value to meet the expense of erecting them. As soon as liberal rotations and improvements are seriously in view, the proper fences become indispensable.

The discernment of the Scottish legislature is manifest, in the antient statutes compelling land-holders to join their neighbours in erecting march fences, in convenient lines : But the state of the country has only of late been sufficiently favourable to lead to their execution on a great scale. The unfenced skirts and marches of different properties can be little better than common lands of the same quality ; and neither in pasturage nor in crop is it to be expected that such exposed lands can become valuable, till the respective rights of proprietors have been guarded by march fences. This is now doing in the southern counties, even on the mountain pastures ; and on arable farms it is more necessary still, and very general.

Not less important, on sheep farms, where the arable system also is followed, are those head or ring fences, by which the mountain flocks are prevented from walking over the whole.

A set of well planned enclosures immediately suggests the idea of security within them. It stimulates the farmer to suitable exertions, and even leads to good system and correct rotations. It answers the important subsidiary purpose of sheltering the stocks ; and, in many cases, also contributes to the drainage of the fields. In consequence of these and other advantages, a man of judgement prefers a well enclosed farm, at a rent considerably higher, perhaps from 30 to 40 per cent. above that of open lands, and sometimes far

Ornament is occasionally connected with utility in forming plans of enclosure, introducing strips and clumps of plantations, or hedge-rows for timber, in suitable circumstances, and other parts of elegant rural scenery. Landholders are interested in every part of a plan of enclosure ;— but in this part of it, their interest is almost exclusive. Tenants are seldom inclined to form any views, except such as correspond with their temporary interest ; and landlords do not often possess a turn for these matters, or bestow attention in any degree adequate to their importance. The plan (which ought to be well considered, and slowly resolved on) is frequently formed in a hasty, perhaps casual manner ; and the execution (committed to those who have given in the lowest estimate) is generally as defective as the plan. Thus, betwixt inattention, want of skill, insufficiency in the works, and subsequent negligence, many plans of enclosure in Scotland fail exceedingly of those important advantages which, in more correct and able hands, they ought to have produced. The practical knowledge and efficient powers of commissioners under bills of enclosure in England, are very much wanted in Scotland ; if they could be obtained under an amicable reference, a regular submission, or the decree of the Judges in the Civil Courts, at a moderate expense.

It cannot admit of any doubt, that enclosures ought to be extended into those districts where

the open desolate state of the fields is most felt. In every part of the Highlands, where any cultivation at all exists, a fence to protect the crops from the cattle and mountain sheep appears to be of the first necessity : and it is not easy to calculate the benefits that would result from well considered and legitimate plans of enclosure, to a proper extent, in the northern and western Isles.

As soon as enclosures and march fences are VI. Fallows
executed, the tenant very naturally thinks of ad- plain or
ditional and detailed improvements. He per- green.
ceives the groundwork of a proper system ; and, finding that his improved crops will be secured, he cultivates them with increasing spirit. Suitable implements then occur to him ; and he not only introduces more perfect modes of the general course of tillage, but his fields are placed in a better system of husbandry, exhibiting either well worked *plain fallows*, in heavy soils, and in such as are very full of weeds, and require complete exposure and working ; or, in light free soils, the *drill husbandry*, with corresponding *grain crops*.

By means of plain fallows, well conducted, the strong soils of the Carse and the Lothians have been brought into clean and fine tillage ; and the benefits are felt in the whole course of crops that follow. By the same means, with the aid of lime,

the wretched soils of barren muirs are exposed to the beneficial influence of the atmosphere, properly broken and mixed, cleared of weeds and rubbish, and rendered fertile in grain and grass. By the plain fallow, also, are croft lands, which have been extremely full of weeds, effectually cleared of them, and their substance either carried off into composts, or decomposed on the soil, so as ultimately to be converted into manure.

Not less conspicuous are the benefits of the drill husbandry with green crops, in free open soils. In treating of this part of modern improvements, the rich and clean fields of turnips to be seen in the counties of Berwick and Roxburgh, and in every other improved part of Scotland, together with the valuable crops of potatoes in all parts of the country, cultivated in drills, and in a soil prepared by the plough, and mostly kept clean by the same implement, cannot fail to occur, and to mark, in a striking manner, the invaluable improvement which has thereby been effected, and which no calculation can reach. The bean husbandry in drills will be associated with the plain fallow, to which it is subsidiary; and with the green crop drill husbandry, of which it is a branch.

Though the general introduction of correct fallows, and of the drill husbandry, for the culture of potatoes, turnips, and beans, is almost within the recollection of many persons, and consequently not of ancient date; and though their

progress at first was reluctant and slow, yet they have given a character to the husbandry of Scotland very much to the honour of the country: their beneficial effects exceed all calculation; and it is hoped that, in a few years, they will find their way into the proper soils and situations, in a more general and extensively systematic manner, to the most remote parts of the kingdom:

It has been said, that enclosures naturally pave the way for other improvements. Fallows require correct work and good implements; and in order to facilitate labour, and to render it more perfect and efficient, the present age has been led to the discovery of more perfect

Implements of Husbandry.

Here it is only necessary to remark, that even the old Scots plough has been materially improved in all respects; that Small's plough tended materially to introduce the use of two horses only, instead of a greater force in the teams, rendering a driver unnecessary, and enabling the skilful workman to make better work; that other improvements have been made by men of genius, on this valuable implement, which is now in a very perfect state, in comparison with what the

old Scots plough was, without even a feather on the spiked stock ; and that betwixt the improved Scots plough for stony land, or coarse and rough stubble, and Small's, Wilkie's, and other ploughs for corresponding soils, the Scots farmer has now excellent implements, capable of working his lands with moderate power, and to good effect.

With respect to harrows, rollers, drills, and other field implements, a corresponding degree of improvement has taken place in the construction and use of them ; and they are, at the same time, neither so numerous as to be oppressively expensive, nor so complicated, as to be difficult to adjust and repair.

The thrashing-machine has done honour to Scotland, as the place of its invention ; and been of such important use in perfecting labour, in facilitating it, and in placing it entirely under the farmer's command, that it is not easy to state the consequences. This machine is now constructed either so powerful or so light, as to correspond with almost any force ;—from the heavy waterfall, or the power of a number of draught horses or oxen, to that of one or two men.

When the soil has been thoroughly cleared of weeds, properly manured, and ploughed so deep as to answer the tap roots of turnips and other green crops, it is then prepared for

Clover and Grass Seeds.

Red clover for hay and soiling; and white clover for sweet pasture, have been of incalculable use in the recent improvement of the soils of Scotland ; not only for the valuable crops which these plants produce, but for the melioration in the soil itself which they make. Ryegrass is chiefly valuable for the crop, and as a suitable mixture with red clover for hay or soiling, and white clover for pasture ; but it cannot be stated as improving the soil : At the same time, if cut or pastured green and succulent, before it carry seed, it certainly does not scourge the soil ; and real perennial ryegrass, in pasture fields properly eaten down, is consistent with progressive improvement in the lands. The general use of these plants for improving the crops of hay or pasture, is not yet so antient in Scotland as to be out of the reach of persons living to trace it back almost to its origin. The progress made by them is great ; but in the Highlands and Isles, where, on lands properly dressed and manured, these plants grow early and luxuriantly, it still remains for landholders and farmers to bring them into general use. By their means, hay will be obtained so early as to be made before the Lammas rains, and so good as to surpass any other ; and it will be in the power of those, who cultivate them

VIII. Ca
ed Herba

occasionally, to use them in soiling, or for the purpose of early and superior pasture. The annual species of ryegrass makes the best return for one crop only; and perennial sorts, (of which the Peacey is considered the best), for standing in pasture. These plants, however, are suitable only for good and well dressed soils.

In order to clothe with useful verdure the barren soft soils of peat mosses, other species of grasses are employed. The Yorkshire fog, or *holcus lanatus*, and the American Timothy, or *phleum pratense*, have been successfully cultivated in Dumfries-shire, and not on a small scale. These plants have answered well, either for hay or for pasture, and they have remained as perennials in the soft mossy soils. At present, the culture of the fiorin or creeping bent, *agrostis stolonifera*, is in process, and under liberal trials, in the same county. By means of these plants, a great deal of mossy and barren soils have been covered with rich crops of grass, in different parts of Scotland. The public attention has been less or more turned to the native grasses of the country for about fifteen years; and the proceedings of the Highland Society have, within the last seven years, increased that attention. Much advantage has been reaped already; but a very great extent of improvement remains yet to be accomplished. Other plants and seeds answer well to mix and improve the crops of *holcus lanatus* and *phleum pratense*; and these may be sown,

in mossy soils duly prepared, almost in any situation. Fiorin promises most advantage, planted alone, on soils which admit of ample floodings to enrich the crops.

One very important mode of improvement for coarse and heavy soils, matted with rough and stubborn turf, is of great importance, and perhaps too little practised in Scotland. It is

Paring and Burning.

This mode of improvement has been, in some instances, mismanaged or abused; and, when followed by severe cropping, it has reduced the soil to a low and exhausted state. A similar injury, however, may be (and has been) done by the use of lime or marl, followed by severe cropping. Paring and burning not only prepares for various crops, at less expense than by any other means, and (fiorin among others) which could not have been cultivated without proper tillage; but it introduces crops, and, among others, rape, into those coarse and unpromising soils, from which the Scottish farmer hardly derives any advantage; and by this very simple and efficient process, the stubborn weeds and rubbish that constitute the turf on these neglected soils, are at once destroyed, and converted into manure; after which, the

tough or spade may be introduced with advantage, followed by valuable crops of corn and grass. It were therefore to be wished, that, in suitable situations, this mode of improvement were more liberally extended in Scotland. It is practicable on soils not easily reclaimed by any other mode; and it furnishes the ashes as an auxiliary article of manure to the farmer, while the produce is added to the resources of the country.

By the lime husbandry, as already stated, very large additions are made to the produce of Scotland; and, of course, the farmer is able to convert part of that produce into farm-yard manure. A similar effect results from the produce derived from paring and burning, and also from that which is obtained by irrigation. The legitimate result of all is,

*The more perfect and extended Use of
Putrescent Manures.*

proper
repar-
Pu-
de- Nothing could exceed the slovenly and ignorant practice of some of the Scottish farmers, former times, with respect to their putrescent manures. Their negligence was even increased when lime and marl were first introduced;

when it became known that, by repetition and exhausting crops, these were of little farther use, the farmer again became obliged to have recourse to his farm-yard manure. Having now also, by the use of lime and marl, or by means of paring and burning, a much greater extent of lands requiring culture and enriching manures, and finding his farm-yards inadequate to a full supply, he very naturally turned his attention to the preparation of composts; and by the labour and expense attending these, he was taught (in a good school) to be careful of the farm-yard. These views introduced turnip shades and yards into the rich districts where straw was in great abundance, and of low value as fodder, exclusive of a turnip crop, though valuable in connexion with it. The same views also suggested to some enterprising farmers to prepare composts of moss or earth with lime, which were found valuable for top-dressings on grass. They led also to the use of composts of earth or moss, with layers of dung, which have been found of essential service in manuring for drilled green crops; and, of late, they have led to new modes of managing the dung of the farm, which is underlaid with moss or soil, and occasionally cleared out to the bottom and carried away; these processes mixing and rotting the whole mass at little expense. The site of the dung, in this last process, being again laid over with a new layer of earth or moss, having the farm-yard manure placed above it, the

whole is again removed in proper time ; and not a particle of the putrid juices or substance of this valuable manure is lost. By similar views, (in weather extremely dry, when the power of evaporation is great), the farmer is induced to cover his manure with layers of soil. In short, in one way or other, the use and preparation of putrid manures has undergone very remarkable improvements. They are commonly applied on the fallows, where they may be covered with soil to enrich more effectually, and to lose as little as possible by sun and air, and where their active powers are to be called forth in order to feed clean and valuable crops, not weeds.

Soiling (or house-feeding with green crops) is only a branch of this part of recent improvement; and as it relates principally to cattle, it does not properly fall to be considered particularly, in an Essay on the subject of Lands in Tillage.

When those improvements which have been detailed above have taken place, the farmer must be inexcuseable if he do not also adopt that in which most of the farmers in Scotland who follow the old systems are supposed to be deficient, viz.

A correct and improving Series of Rotations.

It is admitted, with pleasure, that in some counties and districts, and on some estates and

Improved
Improving
actions.

farms, the rotations are good, and of an improving character. But whoever traverses the kingdom with an observing eye, will perceive, that in this great object, which is of growing importance, there are still many who have made little progress, and who, though capable of raising almost any one sort of crop on their possessions, are yet incapable of bringing themselves to introduce and adhere to a good system, in the sequence of their crops.

It is true, that no farmer should raise crops for which he is not likely to find either consumpt or markets; and that no farmer can raise them in good style, and proper order and variety, without enclosures and manures; nor can it be expected that he will do so, without proper encouragement in his lease, furnishing suitable motives by the prospect of a recompense. These are matters for the consideration of landholders. But though the views of the farmers of Scotland, in general, have been of late much altered and enlarged by the practice of the superior districts, and though improved rotations are now found, less or more, in all parts of Scotland; yet such liberal views are yet rare, as are discovered by some eminent farmers, who adopt no rotation, however improved, in comparison with former ones, unless it promise a steady and progressive improvement of the soil in future.

A farmer is liable to some degree of restraint in forming and realizing such liberal views. There

are some crops for which the markets are not to be depended on, such as barley ; and others for which there is as growing a demand, as there is for wheat. He is obliged to accommodate his practice in some degree to circumstances ; though the nature of the soil might, in his judgment, require a different practice. But, in order to meet such cases, the intelligent and liberal farmer prepares himself ; and, by extra manure or culture, he is often successful.

It is hardly credible what improvement has been made in the ordinary farm rotations in Scotland, within the memory of some who are still alive. The Carse rotation is so incomparably superior in its amended state, as to be considered almost perfect ; and the system of crops in the turnip soils of Roxburgh and Berwickshires, has excited the admiration of all who behold them. Still, there are modes of rotation in the progress of adoption, by means of pasturage introduced in different order, or for a longer period, or by other crops, or what are called double rotations, which promise materially to promote the melioration of the soil : and it is an object of such uncommon magnitude, that every means of encouragement ought to be afforded.

With respect to such lands as are far behind in this important branch,—if the means be afforded, and encouragement given, it may be expected, in the nature of things, (as liberal views and growing intelligence are diffused), that, even in

them, another sort of appearance than what at present offends the observer, will soon be presented.

It has been the general object of this Essay to present a statement of the recent improvements in tillage lands in Scotland, executed by professional farmers, and stated in their natural order of succession.

The want of intelligence, necessary means, adequate encouragement, and suitable accommodations, which retarded improvements in former times, have just been touched on, or barely mentioned, that the work might not swell too much.

In what manner the general spirit of improvement has been maintained, exalted and extended, since the union of the kingdoms, has been simply stated in equally narrow compass.

It will be found, that as recent improvements are here detailed, some of them include others of equal apparent value or importance, though, in reality depending on the former.

The further extension of real farming improvements, will naturally be promoted by a due portion of attention from all concerned in them (and who is not concerned?), bestowed on their present state; and, by a liberal degree of exertion, to remove obstructions, to employ the pro-

per means, and furnish the necessary accommo-
tions and encouragement.

There is hardly any one opinion either more
common or more false, than to suppose that the
real interests of the landholder and the farmer
not coincide in promoting substantial improve-
ments : Nor is it easy, in the present state of the
United Kingdom, to conceive any general object
of so much importance as cordially to unite
them.

Kirkpatrick-juxta, October 1812.

ESSAY

ON THE

SMUT IN WHEAT.

By Mr John Henderson of Brechin Castle Garden.

THE smut in wheat has long occupied the attention of the curious naturalist, and the industrious farmer. But they have neither discovered an effectual remedy for the disease, nor presented a satisfactory account of its nature and origin. Some have supposed that it proceeds from canker in the soil, some from an excess of moisture, some from thunder storms, and some from all these combined ; while others have concluded, that it is produced by insects ; and others still consider smut itself an insect. Of late, Dr Coventry hath represented it to be a canker communicated to the grain by inoculation, as consumption is to the

human body.* To no one of these hypotheses, however, is it possible to reconcile all its appearances.

That it is a vegetable of the tribe of Fungi, is the only account of smut which consists with the general principles of physiology, and connects it with other objects which bear to it an evident resemblance. It is now admitted, that there is in nature no such fact as equivocal generation; and that every animal and vegetable is propagated in a regular uniform process from its parent seed. Some have indeed asserted, that a certain degree of putrefaction will generate the smaller insects, and that heat and moisture produce the lichens, mosses and fungi on stones, trees, &c. The supposition breaks the harmony of creation, and contradicts the first principle,—*nothing will produce nothing*. Never was an insect produced but by the regular process of generation; and never a lichen, moss or fungus, which did not spring from its kindred seed; nor is there any proof that one new species has been added to the system of nature since the creation. Smut must therefore have its appropriate seed; as a chicken can be hatched only from an egg, or an oak reared from an acorn.

Dr Withering has described a kind of smut as a vegetable, and denominates it, *Reticularia Segatum, brown blackish parasitical fibres within*.

* See Farmer's Magazine, Vol. V. p. 34.

‘This,’ says he, ‘is the smut so frequently found upon the ears of different sorts of growing corn, and also on grasses. It consists of very minute egg-shaped stemless capsules, at first white; but the thin white coat soon bursting, it pours out a quantity of brown black powder, mixed with wool-like fibres.’ This, though sometimes found on wheat as well as other kinds of corn, is not the true smut so noxious to that sort of grain, but is provincially denominated *blasted ears*, and is by the country people supposed to be the effect of lightning. These plants complete their whole progress in a few weeks; whereas the true smut takes nearly as long time as the wheat itself to ripen its seeds. The real smut again has no woolly fibres, and, being in the ball form, would appear to belong to the genus which botanists have named *lycoperdon*. This is a very numerous tribe of plants. They are generally very minute, and are found growing in many different situations;—on the soil, on stones, on horses’ hoofs, on bones, on rotten wood, and on living plants. When their seeds are ripened, the balls which contain them burst, and their fine powder flies off and floats in the air. Some of the larger species are known to almost every body by the vulgar names, *puff-balls*, *blind men’s eyes*, *the Devil’s snuff*, &c.

In the history of these minute plants we discover many facts analogical to the appearances exhibited by the subject of the present inquiry. Mildew, and rust in particular, seem to be nearly

allied to it. Mildew, by its habit, appears to belong to the genus *Mucar*, which is the most common of all the minute plants. It is found on cellar walls, casks, and the corks in bottles of sour ale, on old shoes, spoiled fruit, rotten vegetables, old cheese, and the black spots in sycamore leaves. Several of the species have flower-stems, and seed pods ; and all, seen through a microscope, appear like forests in miniature. Mildew is found on the upper surface of the leaves of plants, and is at first like a very fine white powder. On some plants it sends out a sort of threads, or roots, resembling mushroom spawn, which terminate in stemless capsules, shaped like inverted cups, and tinged with a blackish hue at the time the seeds are ripened. The plants most liable to mildew are peas, beans, white thorn, barberries, all sorts of fruit trees, and especially peach trees in hot-houses. Rust, though it in some respects resembles mildew, exhibits in some of its stages a specific difference, and appears to have a great similarity to some plants termed *Fungi Pexiza*. Different from mildew, it is always on the under side of the leaf. At first it appears a fine reddish brown powder, like the rust of iron, but is soon formed into distinct protuberances, in the shape of inverted cups, much larger than mildew. Some varieties have the appearance of transparent jelly ; and as they advance in age, grow dark in colour, and seem to emit seeds from the whole surface. Rust destroys the leaves of plants, making

them to drop off, or to assume an autumnal appearance. It destroys the leaves and stalks of corn before the grain is filled, and proves more extensively hurtful than even smut. On corn and grasses, and particularly on wheat, it grows flat, and appears imperfect; on beans, roses, and peppermint, it is found in the form of considerable protuberances; and on poplar trees, coltsfoot, and sow-thistle, has the appearance of large flat patches. Whether the same seeds, dispersed indiscriminately on different plants having leaves of different textures, and affording various kinds of nourishment, will produce the apparent specific differences, or the plants have each their peculiar parasitic fungus, is left for the discussion of others. It is certain, they are always found in the same form; and this is sufficient to prove that rust, as well as mildew, is a vegetable; and confutes the opinion, that they are oily substances, exhaled by the sun from the flowers of plants, and condensed again by cold dews. Both evidently ripen their seeds by that immutable process which in plants is the same from age to age; whereas, in the changes of the Fossil tribe, there is variety without end. The seeds of these, and many of the smaller lichens, mosses and fungi, are specifically lighter than common air, and would continue to float in the atmosphere did they not mix with its aqueous particles. The fact is thus easily accounted for, that they are

copiously distributed in time of rain, and during mists and dews, and especially in damp situations. In such abundance do these seeds float in the atmosphere, at particular seasons, that the physician might perhaps ascertain a connexion between the impure atmosphere they produce, and many periodical diseases; and, by botanical researches among the minor plants, might discover both the cause and the cure of several complaints affecting mankind.*

Smut is distinguished from other parasitical plants found on corn and other vegetables by its situation, and takes possession of the capsules which Providence intended to be filled with the food of man. This, however, is no objection against its being a vegetable. Botanists describe many plants in situations as wonderful. *Tremella mostoc*, which the common people imagine to be the remains of what they call *falling stars*, resembles jelly, and is found growing among grass. Another species, like spilt cream, is found on gra-

* Rust and mildew are communicated from the atmosphere; and operate so suddenly, that it seems impracticable to provide a complete antidote against their effects. They prevail most in low, damp situations, and in the vicinity of woods, hedgerows, and winding rivers. The land should be carefully cleaned of every sort of weed; manure should be restricted to green crops, sowing thin and early; and every thing else which tends to prevent the lodging of the corn should be adopted. Hedgerow trees should be discontinued, and quick fences kept low. These things would lessen the evil—but in rainy seasons nothing will prevent it.

vel walks and hard stony places ; and others, having the appearance of green salve or transparent jelly, grow on rocks in the sea, and adhere to marine plants. One species of *Reticularia* rises from old wood in the form of yellow paint. Its seeds are enclosed in a sort of bag or skin, having extremely fine woolly fibres, and, when ripe, are discharged in the form of a fine reddish brown powder. Another species grows on tanner's bark, and will spread in the form of yeast for several feet. The seeds of both species are very fine, and have a great resemblance to smut. If the powder which they form is rubbed on the hand, it will prevent its being wetted in water ; a proof, that an application more powerful than is commonly employed, is necessary to remove the evil so much complained of.

It may be inquired, How comes it that a stalk and ear so perfect as wheat should yield nothing but fungi ? But in how many instances is the most effectual provision made for the preservation and propagation of both plants and animals, which to us appear useless or noxious, as well as of those with whose use we are acquainted ? A fly deposits an egg on the leaf of an oak or a willow, and thus secures a comfortable lodging for the young maggot ; and it is worthy of remark, that the cell consists more of the texture of the trunk, than of the leaf of the plant. The seeds of many of the fungi are more strongly fecundat-

ed by passing through the stomachs and bowels of animals. The *Agaricus campestris*, or common mushroom, is generally raised, not from seed but from spawn or roots; and new spawn is produced from horse or cow-dung; an evidence, that the seeds of mushrooms are deposited on the fodder of these animals, and are preserved and nourished in their stomachs. Worms, too, are conveyed into the bowels of animals along with the food. Dr Buchan says, 'I have known children of the same family nursed by one woman having worms, while those nursed by another had none.' If the eggs of worms pass through the fine vessels of the body, and are thus communicated from one to another, then may so fine a powder as smut ascend with the juices of the young plant, and obtain access to the very fountain of life.*

* This subject would have admitted of copious illustrations from the cases of mites in cheese, meal, hay and straw. In a warm summer's day, what countless millions hum in the air whose chief employment, during their short existence, is to deposit eggs on trees, grass, and corn, so that hardly a blade can escape being loaded with them! I have seen mites which might have been taken up in shovelfuls like sawdust lying round a hay-stack which had been built about three weeks; and how many must the stack have contained! The eggs of these insects must pass into the stomachs of the animals which feed on the vegetables thus covered with them. The dung or droppings of horses, kept ten days in a house, a preparation for mushrooms, will not only be all an anim-

The only other inquiry which seems connected with this view of the subject is this—How are the seeds of smut communicated to a field sown with wheat apparently uninfected? To this the answer is easy. The seed of smut, like that of all the fungi, is extremely fine and light; one ball of it diffused among seed-wheat, is sufficient to taint a field of ten acres. It ripens with the wheat; and its natural time of sowing is in harvest, when it may be conveyed from field to field by winds, rains and dews. In this manner, it may be spread over a field in which no smut can be discovered; though still, among the wheat with which it grew, it will be most copiously distributed by reaping, carting, stacking, thrashing, or any other sort of friction. There is, therefore, it may be here remarked by the by, no security in taking seed from a field apparently clean of smut. In every case, it is proper to employ steeping.

This general view of the subject appears to exhibit an account of smut harmonizing with all its own phenomena, and illustrative of the analogy it bears to other substances apparently simi-

ed mass of mites, but will soon be metamorphosed into small black flies, in numbers which will darken the windows of the house. These eggs may float through the milky vessels of cows; and thus will find their way into cheese, in which, like the seed of weeds which may lie in the earth a hundred years, they will continue dormant, till air, heat and moisture, ~~catch them into life.~~

lar to it. The farmer's interesting object is, to remove the malady; and this will be effectually accomplished by the following preparation.

Take of best soft green soap made from fish-oil 1 lib., and of scalding water 4 gallons (8 Scots pints.) Put the soap into a glazed vessel, with a small portion of the water; continue stirring it, and add the water as it dissolves, till the whole is a perfect lie. It should be used about 90° of Fahrenheit's thermometer, or new-milk heat. Put the wheat into a tub, and pour on it a quantity of the liquor sufficient to cover it completely, and throw a blanket over it to preserve the heat. Stir it every ten minutes, and take off the scum. When it has remained in this manner for an hour, drain the liquor from the wheat through a sieve, or let the tub be furnished with a drain bottom like a brewing vat. Let the liquor which was drawn off stand a few minutes to subside, and then pour it off the sediment. Repeat the operation till your whole quantity is steeped; only observing to add, each time, as much hot lee as was absorbed by the former steeping. Dry the wheat with quicklime, and sow as soon as convenient. It will keep ten days after steeping; but should be spread thin on a dry floor.

Three lib. of soap, and 24 Scots pints of water, will steep half a boll of wheat. If a tub with a drain-bottom is used, such as a hogshead, with a spigot to draw off the lie, 4 ounces of soap, and 1 gallon (2 Scots pints) of water scalding

hot, will preserve a stock of warm lie sufficient for any quantity of wheat; and, allowing five minutes for draining, five bolls may be done in eleven hours. The operation should be performed in a clean place, at a distance from barns and granaries, the roofs of which may be observed hanging full of smut. The refuse of the smutted wheat should be buried deep in the earth, and not thrown to the dunghill, from which it would be conveyed to the field.

This prescription was first employed, under the idea that smut was an insect; and its effects on all animated substances are very powerful. In a second it destroyed insects, which were, without sustaining the smallest injury, immersed twenty hours in corrosive sublimate. Former steepings failed, from employing saline substances, which rather fixed than removed the smut: whereas this has a strongly cleansing effect: in half an hour it made a watering-pot as clean of paint as when it came from the tin-smith. Steeps were early introduced into husbandry, for the purpose not only of removing distempers, but of increasing the fertility of the seed. That some of them may have answered the former of these designs, may be granted; but with regard to the latter, much stronger evidence than any that has been produced, is still wanting to confirm their boasted effects. The Romans had their lies of oils, decoction of cypress-leaves, juice of house-leek, &c. Had modern agriculturists combined

their saline lees with the Roman oils, smut would have been removed ; but, as to additional fertility, the compositions could only have acted as manure.

Although I have the fullest confidence in the receipt, I would recommend to sow grain apparently free of smut, unless it has stood a year on the straw, or been thrashed in a mill. The flail breaks the balls of smut, and knocks its seeds so much into the pores of the grain, that some of them may be placed beyond the reach of the lee, and especially in hungry grain, in which the breast is flat, and the groove deep. A grain of wheat, magnified, appears like a cream-coloured sow, with strong bristles ; and thrashing, especially when the grain is damp, or soon after reaping, will fix more deeply any seeds of smut adhering to them.

Some, on the supposition that smut is produced by insects, have recommended kiln-drying the wheat to prevent smut. They discovered a few dead maggots among the dried grain, and imagined they had solved the problem as to the nature of the disease ; and that all that was needful for its removal was only to apply a degree of heat strong enough to destroy the eggs of the insects. It is evident, however, that these maggots were produced from the eggs of insects deposited on the corn, either in the field or in the granary, which would have in time devoured the grain, but would not have turned an atom of it to smut,

Moderate drying might be a substitute for keeping the seed on the straw ; but great care is needful in guarding against such a degree of heat as would destroy the vegetative power of the seed.

Others have recommended change of seed for the cure of smut. For this purpose, it is successful only in so far as the change is from a field less infected with that evil ; though it is true that change of seed will improve the quality of the grain, if due attention be paid to the particular sort or variety of the changed seed, and to the soil from which the new or changed seed is brought.

Others again have thought, that well ripened seed would both prevent smut, and ensure a large crop ; an opinion at variance both with philosophical research and experience. But without going farther into a detail of opinions and prescriptions, the following experiments will show the effect of the application now recommended, and will exhibit, in a connected view, the result of inquiries on the subject.

In 1801, T. M. Esq. brought from Manchester a small quantity of Egyptian wheat. *

* This grain has a strong, solid stem, a thick, massy, awny ear, having one long capsule, and several short ones, springing from its base. A gentleman who examined this species of wheat in its native soil, informed me, that there the lateral ears grow nearly to the length of the leading one. Pharaoh saw, in his dream, seven ears on one stalk. This

first year he sowed it in his garden, and the next in a field along with common wheat; and there it was first tainted with smut. Mr M. gave seed from this crop to several gentlemen, who prepared and treated it in the same manner with their other wheat. They continued to sow it, some for two, some for three years, and Mr M. for four. Each succeeding year it became more foul, till it was thought to be absolutely useless. The soils in which these experiments were made, possessed considerable variety, but were in general light; and the consequence was, that the large massy heads degenerated to little more than the size of common ears, and this in proportion to the lightness of the soil. The seeds with which Mr M. presented me were from his garden crop; these, I am persuaded, were free of smut; and would have remained so for ever, if kept at a proper distance from smut in other crops.

I have sown this wheat for five successive years; and in none of the crops has a particle of smut been discovered. I divided the ground in-

was an emblem of fertility, and was as natural as seven kine feeding in one meadow. The wonder consisted in the lean devouring the full ears. Even in this country, the return is very large. In a good soil, every ear will contain from one hundred to one hundred and forty good grains, double the size of common wheat; and, if not sown too thick, every grain will produce, at an average, ten stalks, making, in all, above a thousand fold.

to two parts ; and sowed one half with the best and most fully ripened seed, and the other with small hungry grain, only not so light as to swim in water. In the five successive sowings, not the slightest difference could be discerned, either in the quantity or quality of the produce. The soil was a mixture of black mould and red clay, upon a substratum of red clay or till. The heads still retain their original size ; a plain proof, that continuing in the same soil does not diminish the size of the grain ; while this effect was, in the other experiments, produced by change of soil.

Last year I got from Mr M. a quantity of his Egyptian wheat from the crop which had been thrown by as useless, and had been in a mill-loft, in which smut is generally to be found in great plenty, for nine months, and was as black as if it had been rolled in soot. This I steeped and sowed in one patch ; and, in another, after steeping it, I sowed a sample of common wheat, which had also been smutted. Both crops were carefully examined ; and no symptom of smut could be discovered in any of them, either when growing or when harvested. Only it is worthy of notice, that the heads of the Egyptian wheat were all single. A course of experiments only could determine, whether continuing to sow on a stiff soil would restore its original fertility or exuberance.

I sowed another sample of common wheat, soft hungry grain, which had got a great deal of

rain in harvest, and was much blacked with smut. One half was steeped, and the other was sowed without any preparation whatever. In the produce of the former, there was about a twentieth part smut; and in that of the latter about a third part.

These experiments appear to warrant the following conclusions.

In the *first* place, That smut is a vegetable, and, when communicated to grain, will propagate rapidly.

Secondly, That no certain remedy can be applied to damp, raw grain, without keeping a twelvemonth, or previously drying it.

Thirdly, That, with these limitations, the soap lie is a complete cure for smut, even in the most virulent cases of the distemper.

Lastly, That change of seed is no security against smut, and will not (except under peculiar circumstances) improve the grain.

9th January, 1809.

APPENDIX

TO THE

ESSAY ON THE SMUT IN WHEAT.

By MR HENDERSON.

It was formerly stated, that I had raised Egyptian wheat in the same soil, without smut, for five years, and that some smutted seed given me by Thomas Molisson, Esquire, had been effectually cleaned.

My list of crops down to this year is as follows.

Large headed Egyptian	-	6 years crop.
Single headed ditto,	reclaimed	2 do. do.
Red wheat reclaimed	-	2 do. do.
White wheat reclaimed	-	2 do. do.

All these have been cultivated on the same kind of soil, though not on the very same spot of ground; and the experiments establish the principle, that change of soil has no connexion with smut.

In the autumn of 1808, severals made trial of the steep I have recommended. I examined their fields, when the crop was nearly ripe, and found them all perfectly clean.

In order to obtain the most satisfactory information, Mr Molisson procured two bolls of the best English wheat, had the one pickled with chamber-lye, and committed the other to my charge, to be prepared in the manner I have described. Both were sowed in the same field, the soil on a gravelly bottom, and after summer fallow. There was no apparent difference between the crops till they were almost ripe ; but at that period a considerable number of smutted heads were discovered in that division of the field, the seed of which had been steeped in the common manner, while in the other, not a blackened ear could be seen. A number of gentlemen, farmers, and others, inspected the crops, and all declared that the experiment in favour of the soap lie was completely conclusive. About a peck of the seed steeped according to my directions being left over, after lying about two weeks on a barn floor, it was sowed in drills on the same light soil, after potatoes. Even in this crop, no appearance of smut could be perceived by general inspection ; but it is said a blackened head or two was discovered by the reapers. Admitting this to be a fact, there are different ways of accounting for it, without prejudice to the efficacy of the soap lie in destroying smut. The seed, it is to be remember-

ed, had lain, after steeping, for near two weeks on a barn floor, in which smutted grain had been thrashed; and as there were in the barn a number of sacks filled with wheat, which had not been cleaned in any manner, the very dust of the place was sufficient to contaminate the seed, though it had been at first effectually cleaned. But it is possible the heads, which the reapers took for smut, might be only sprung ears. These are often thus mistaken by common observers. A gentleman, who laughed at every prescription for the removal of smut, imagined, when he saw a number of blackened heads in a field, the seed of which had been steeped, that he had found a decisive confirmation of his opinion. The heads were indeed black with rain, and some of them rotten; but a dissection of them convinced him that they were not smut, but only sprung ears. These things are mentioned, to prevent the effect of a careless inspection of experiments on this subject. Partial failures, on account of circumstances which prevent the full application of the prescription, or appearances mistaken for failures, may bring contempt on a recommendation which, fairly tried, will be productive of essential benefit to the country.

All my observations confirm my former statement, that smut is a vegetable, and that there is no expedient for removing it so effectual as washing in soap lie. Many inquiries have been made for the receipt; and I should suppose it will

have a pretty extensive trial. And I may venture to predict, that a due application of it for ten years, would banish from our fields the evil of smut.

In my former paper, I mentioned the effect of a light soil in reducing the size of the ears of Egyptian wheat. At that time, I had only made one year's trial of a change to a stiff soil, and could not determine whether such a transition might not restore the grain to its original bulk. After another year's trial, it appears to be settled in a completely distinct variety; with this difference from the original, that it has a single husk, somewhat like barley, with four regular rows of grain, all equal in size. The awns remain, but are not so strong as formerly; the stem is still large, but not so massy; the upper part is a sort of pipe, though not so open as in the common kinds: whereas in the original, it was as solid as a rush. Although the Egyptian wheat yields a return large beyond example in this country, the culture of it in our climate is liable to several weighty objections. In the best of our seasons, a number of grains in the massy head never fill. If much rain fall before cutting, it is apt to sprout in the ear, from the water lodged in the thick husk. It is also very subject to mildew; and, when affected with it, is good for nothing. Many are of opinion, that this new variety will, on these accounts, prove a valuable acquisition. The grain is much weightier than any in common use; and

the straw is so strong, that it will not lodge. I never could discover a particle of rust on the chaff of the ear, and it was but very partially affected with mildew, while other kinds, on both sides of it, were rendered useless : And, which is no small recommendation, it appears to be as hardy as any of the common winter wheats. A comparison of this new variety with the original Egyptian wheat, would suggest the idea, that there are not so many distinct species of that useful grain as are marked in our catalogues. No country is specified as its native soil ; and it is not improbable that all the varieties we now name, may have been raised from Egyptian wheat, cultivated on different kinds of soil. That grain might be part of Noah's store in the Ark, and being, after the deluge, sown on the banks of the Euphrates, might be thence carried into Egypt.

It may only farther be observed, that this grain is greatly improved by sowing it in drills, and hoeing in the month of April.

SIR,

Brechin Castle Gardens, Jan. 2, 1811.

In compliance with the desire expressed by you on the part of the Highland Society, I have been prosecuting my inquiries on the subject of Smut, and now send you an account of experiments made last season, with some directions for the application of soap lee to other purposes. Your laying these before the Society at their ensuing meeting, will oblige,

SIR,

Your most obedient servant,

JOHN HENDERSON.

Lewis Gordon, Esq.

EXPERIMENTS ON BARLEY SMUT.

This species of smut is by Dr Withering denominated *Sphaeria Segetum*; and it was proposed to ascertain by experiment, whether the steeping which was successful in removing the smut from wheat, would have the same effect on this evil in barley.

The tenth of an acre was divided into four patches. No. 1. was sowed in November with English barley in drills. No. 2. in February, with ditto in ditto. No. 3. in February, with spring wheat in ditto. No. 4. in May, with barley in ditto. On the same day with the last sowing, about six acres of barley were sowed broadcast in the field. The seed for the four patches was carefully steeped in the manner prescribed for the smut in wheat.

The result of the experiments was as follows. The November sowing had only a few smutted ears. That of February had about double the quantity of the November. The May sowing again had double the February. The field sowing, in which no steep was employed, was equally clean with the patch sowed at the same time. The spring wheat had as much barley smut as the barley itself, but not a particle of the true wheat smut.

These facts all concur in establishing the conclusion, that barley smut does not adhere to the seed, and that, of course, any application previous to sowing would be useless. From observations in this and former seasons, it also appears that this evil prevails most on late sown crops, and in wet seasons.

It was formerly observed, that the barley smut differs considerably from the species found on wheat. The former arrives much sooner at ma-

turity than the latter ; and the one is thus early dispersed, while the other, remaining in balls till the reaping of the grain, is, as was formerly mentioned, by various operations made to adhere to the seed. In what manner the subsequent communication of Barley smut to the crop takes place, it is impossible as yet fully to explain. The evil prevails most in wet seasons ; and the germs of these parasitical plants, it would appear, are deposited during heavy rains, when the crop is in what is called the shot blade. At this stage, the uppermost stem of the leaf grows funnel shaped, and being extended by the growing of the ear, is most susceptible of injury ; while, at the same time, after a heavy rain, followed by continued humidity in the atmosphere, the funnel will remain full of water. This stagnant water must become corrupted, and will have an injurious effect on the tender corn, which will soon become food for the newly deposited smut, as it is evident that all the fungi feed on corrupted vegetables, and especially those which have been soaked in water.

If a name were wanted to this species of the malady, the most important circumstance in its history might be exhibited in the appellation *Summer Smut*. From the whole it appears, that, for this, there is no radical cure ; and that early sowing is an eligible palliative. As an additional proof of the efficacy of this practice, it may be mentioned, that this summer smut is rarely found

On wheat sowed in autumn, while that which is sown in winter or spring will have a proportion with other grain sown at the same time. Early sowing also greatly improves the quality of the grain. In the above cases, the earliest patches yielded by far the best grain; and in all former experiments, the March sowing has proved much superior to the May.

In the course of applying the steep for wheat, an improvement was suggested by the following circumstances.

In October last, 20 bolls of one year old seed were steeped. Of these 5 were dried with lime, and sown the day following. The 15 bolls which remained, were spread about 18 inches thick on a loft, without lime. In bringing forward the different operations of dunging, ploughing, and harrowing, it was nine days before the whole was got into the ground. The sowing of the 5th day vegetated so rapidly, that in eight days the field appeared green at a mile's distance. The sowings which followed advanced in the same proportion. But that which was first sown, and dried with lime, was, on the 15th, not farther advanced than that which was sown on the 9th day. It will therefore be a material improvement to discontinue the use of lime in drying the seed after steeping; and, when the weather is dry, to allow it to lie two days in a heap covered with a cloth. The vegetation will be thus much accelerated; and it appears to have been on the

same principle that the Chinese applied a warm bath of the boiled juices of different kinds of dung. A quick and free vegetation has no small influence on the crop, makes the roots take a deep hold of the ground, and prevents their being thrown out in winter.

ON DIFFERENT APPLICATIONS OF SOAP LIE.

The principle on which the soap lie is effectual for destroying smut, renders it applicable to many other practical purposes. For a course of years the writer of this article has made various trials of it, and now submits such receipts and observations as appear to be connected with the objects patronized by the Highland Society.

For Destroying Insects on Animals.

Take green soap 1 lib., scalding water 4 Scotch pints, (2 gallons English), and sulphur 8 oz. Dissolve the soap in a glazed jar, with a portion of the scalding water, and at the same time let the sulphur be incorporated with it. Dogs may be partly immersed in a tub of the liquor. Sheep may be placed in a tub, and the liquor may be poured from a jug in amongst the wool; rubbing it with

the hand till the skin is completely wetted. For horses and cows a flannel cloth should be soaked in the liquor, and rubbed on every part of the body; taking care that the liquor have a due mixture of sulphur. In all cases, it is absolutely necessary that every part of the body of the animal be subjected to the application.

This prescription has been employed on cows and horses infested with lice; on sheep with kids and scab; on dogs under the mange; and, in the most virulent cases of these diseases, has proved completely successful. It is preferable to any in use at present; is cheap; and, while it removes the disease for the cure of which it is applied, has no bad effect on the health of the animal itself. In sheep, in particular, it has this recommendation, that it does not injure the quality of the wool. Sulphur has been long an approved article for removing irritation on the skin of animals infested with insects, and, in particular, grease has been joined with it; but on woolly and hairy animals, the most complete and effectual application will be found in its union with soap lie.

For Destroying Insects on Fruit Trees, and other Vegetables.

Take green soft soap 1 lib., scalding water 4 pints Scotch, sulphur 4 oz., spirit of turpentine 1 gill. Let them be incorporated before the soap is dissolved. Take a painter's brush, dip it in

the mixture, anoint the fruit trees in winter; and it will effectually destroy the eggs of the insects which in spring make such havock on the leaves.

This receipt would destroy the insects on larch trees; but the application of it to grown plantations would be difficult. It might however be of great use in forming a young plantation. It would be easy to dip the young plants in the mixture; and, if kept at a distance from infected trees, they would continue clean. Two men, dipping handfuls at a time, might prepare 100,000 in a day; and, labour included, the whole cost would not exceed 10s. This expedient is the more needful, as all plants from nurseries which have larch hedges, or from the vicinity of larch trees, are sure to be infected.

The application would also be effectual against the pine bug. Only in this case the sulphur must be omitted: The liquor should be kept at the heat of 96°, and the plants, after being divested of their roots, should be immersed for 10 minutes. After this, the plants should have new bark, fresh earth, and clean pots. This mode of treatment has been completely successful, in two cases of plants from infected houses, and in five of plants direct from the West Indies; so much so, that not an insect has been seen in the stock for twenty years. These circumstances have suggested the extending of the receipt to the sugar plantations; and though it does not lie within the province of the Society, the writer mentions it as a

matter of public utility. The insect which infests the sugar-cane, is the same with the pine bug; and this prescription would extirpate it. The cane sets should be immersed in the mixture for 10 minutes, and planted in clean soil; either new ground, or ground which has been completely cleaned by trenching and fallowing. No aloes, pines, or succulent plant of any kind, should be suffered to grow near sugar-cane ground, unless they have been, before planting, soaked in the liquid mixture.

For Cleaning Orange-Trees and Myrtles.

Take soap 1 lib., water 4 pints, sulphur 4 oz. The heads of the trees may be immersed in this liquor, or the trees may be washed with it by means of a sponge.

When plants have limber leaves, and are infested with the red spider, take soap 1 lib., water 6 pints, sulphur 4 oz.; immerse the plants in the liquor, and take them out instantly.

In all cases of plants with leaves, pine apples alone excepted, turpentine is to be excluded from the application.

Brechin-Castle, 2d January 1811.

ESSAY

ON THE

MILDEW IN WHEAT.

By Mr JOHN HENDERSON of Brechin Castle Garden.

THE injuries to which wheat is liable, have of late years become a subject alarmingly interesting. In 1810, an inquiry into the cause of the failure of that year's crop was proposed by Sir John Sinclair; and all his correspondents agreed in ascribing it to mildew. There remains, however, a diversity of opinion on the nature of this evil; a point, of very considerable importance in order to the discovery of means for its removal. The Conductor of the Farmer's Magazine, exhibiting the result of Sir John's Report, endeavours to expose the opinion that mildew is a parasitical plant; and would represent it as a mistake of the effect for the cause. It is not intended,

ed in this paper to attempt a scientific discussion of the question : a relation of some facts, which several years' experience has furnished, with some observations on them, is all the writer proposes in this communication.

There are two kinds of mildew. There is one which follows heavy rains, succeeded by a damp atmosphere, and still, quiet weather. It will be found on luxuriant, lodged corn ; and the quantity appears to be much regulated by a number of circumstances in the local situation of the field. A breeze of wind, accompanied with sunshine, kills and dries this substance on the grain, and leaves it full of black spots, which gum up the pores of the stalk, stop its perspiration, and produce a premature harvest. It is not till it changes the straw to a black colour, that this kind of mildew is generally observed. It is a sort of that vegetable substance which is commonly denominated Mould, and is allowed by botanists to belong to the class *Cryptogamia*, and the genus *Mucor*. Insects, it has been thought by some, are intended to promote the decomposition of the bodies of larger animals ; and it is not improbable that the numerous tribes of fungi, and particularly Mould, may accomplish the same purpose in relation to vegetables. When we discover Mould on an orange, we are certain that the process of corruption is begun ; and indeed, on any vegetable Mould, must produce an injurious effect. The general fact is, that it follows damp ;

and it would appear that its seeds are constantly floating in the atmosphere. An antidote against this evil may therefore be sought in all the expedients which promote a free circulation of the air,—such as keeping the ground clean of weeds, sowing thin and in drills, discontinuing hedgerow trees, and having the corn land at a distance from plantations. This may, for distinction's sake, be termed White mildew.

There is another sort of Mildew which is much more noxious to grain, and to which it is more properly the object of this paper to attend. This, from its resemblance, at one stage of its progress, to the rust of iron, has been termed Rust. Most commonly it is lodged on the under side of the leaves of plants. Like the white Mildew, it is a fungus, and appears to belong to the genus *Lycoperdon*. Wheat is affected in the following manner. On the leaves, and sometimes on the ears, are discoverable longitudinal spots, which at first appear of a livid yellow colour, but are soon changed to brown. The leaves become striped; the perspiration is obstructed; the juices of the plant are dried up and depraved; the stalk cracks in a number of places, and about the middle and upper part is filled with a brown powder or rust. When the evil commences early in the season, the cracks on one stalk enlarge, and spread the infection to others around them. After the powder is arrived at a state of maturity, rain will wash it off; and all the parts of the straw which were af-

fected by it will be observed black, and those not affected remain green, and do not whiten in harvest. The facts which follow will exhibit those appearances of growth and increase which we would expect to find in Mildew or Rust, supposing it to be a parasitical plant.

One crop much rusted may infect the crop of the following year. Over all this district, beans have of late been very subject to this evil. This year, they lost their leaves long before harvest ; they never ripened ; and many of them were not half filled. I examined four fields of wheat, one in the parish of Brechin, one in the parish of Montrose, one in Dun, and one in Stracathrow, and they were all very bad ; every stalk appeared to be rusted. Their situation was open and exposed ; they were all at a distance from wood of any kind ; and the evil could not be imputed to any thing except the crop of the preceding year, which in every one of them was beans. Some other fields I found rusted, but not so much ; and these were after potatoes. I have not actually observed rust on this vegetable ; but its leaves seem to be much fitted to be a lodgement for it, and may easily infect the ground, though not to such a degree as beans.

There are also certain situations in which rust seems to have taken up a permanent residence, and to exhibit appearances of a rapid increase. The vegetables most liable to this evil are barley, tussilago, peppermint, roses, balsam, poplar, birch,

fiorin grass, mountain ash, * &c. I am now more confirmed in the opinion, that the various appearances of rust on different plants are to be ascribed to the different texture of the leaves: the leaf of a rose, for instance, were it dissected, would appear like a net; and the spots of rust on it are circular, and correspond in size to the meshes of the net: grass or corn, on the other hand, would be found like the threads of a web without the woof, and, on them, rust is seen running more in the form of lines. The fact, however, is admitted on all hands, that certain plants are very liable to rust. On all those named above, it has been increasing these six years in the garden and its vicinity. In 1807, I planted peppermint on a piece of ground on a wall border, with a north-east aspect, and separated from the shrubbery by a walk. The first year the crop was good, and no rust; but in the succeeding years it increased so much, that the produce was good for nothing. In a garden about a thousand yards distant, I found peppermint perfectly clean, and procured plants from it; placed them in an open space in our garden; and even this year the crop is as much injured as in the second year of the former trial. Nor is it unworthy of remark, that the peppermint, from which these plants were taken,

* Barberry trees have been thought to produce mildew on wheat; but neither it nor white thorn, though both are very subject to white mildew, have any connexion with rust.

remains as clean as ever, although the garden is shaded by a wood, and deprived of sun near one half of the day. For the last three years our poplar trees have been so much rusted, that they have lost their leaves in August, whereas, in some situations, they retain them till October.

The influence of an infected soil and situation in propagating rust, particularly on the wheat crop, is evident from the facts which follow. In a piece of experiment ground, of about half an acre in extent, I have raised a number of rotation crops, as wheat, barley, beans, potatoes, cabbages, turnips, &c. The land is a black mould mixed with clay and sand, on a subsoil of strong till-clay. It lies on the north side of the garden; is separated from it by a shrubbery; on the north and west is skirted by a belt of planting twelve years old; and is about 800 yards from the river Esk, and 50 feet above its level. A fourth part of the plot, or 20 falls, was every year appropriated to the culture of wheat, and was divided into drills nine inches apart, in which were sown from four to six different kinds. The first three years no rust was observed on any part of the crop. The fourth year, a small portion was discovered on the end next the shrubbery; and, since that time, every succeeding year has been worse than the former. This year's crop (1811) is so much injured as to be almost useless. The different kinds were affected in the following proportions.

No. 1. Real spring wheat, was least injured.
Not attacked till September.

No. 2. Egyptian, was a degree worse. Attacked in August.

No. 3. White Common, was a degree worse than No. 2. Attacked in July.

No. 4. White Brabant, affected in the same degree as No. 3. Attacked in July.

No. 5. Red ditto, worst of all; completely black, and straw rotten: And this, it is to be observed, was attacked so early as June. In all the cases, the magnitude of the evil corresponds to the earliness of its commencement. Red wheat was always the most affected, except in 1810, in which season creeping wheat was worst of all. In 1810, also, spring wheat had no rust; and it was its first year on the soil. There is a particular circumstance, in relation to the seed of the common white wheat, which deserves to be mentioned. It was taken from a quantity which was sown on the same day, in a field of about 20 acres, half a mile from the experiment ground. The soil was nearly the same, and the distance from the river about equal. But this field was at a distance from plantations, excepting a few trees on the north side. It had never been wheat in the memory of man, and had been fallowed for two years preceding: the consequence was, that no rust could be discovered on any part of it. A confirmation of the conclusion, that, in the above instances, the infection was communicated from

the soil, may be found in the following facts, which took place also on the experiment ground. In May 1810, I planted about a twentieth part of it with fiorin grass, taken from a ditch on the south side of the garden. In summer and autumn following, it made considerable progress; and now there is a pretty good matting of grass on the ground; but in June last, and during dry weather, the rust began to appear; and now every thing is rusted more or less. I planted fiorini grass with wheat sown in October, and made the same trial with barley sown 1st of April. In the first case, about a fourth of the plants are rusted; and of these the strings are all short. In the other, there is more rust; and the plants, though sufficient in quantity, are weak.*

Rust, it therefore appears, may become peculiarly attached to some soils and situations; and,

* Fiorin grass may be mixed with a grain crop in the manner which has been long practised with other grasses. I would recommend the following method for planting it. Immediately after winter wheat is sown, let it be ploughed down with a light furrow, or fix to the plough a drill-machine for running the wheat neatly in. Employ a number of women or children, as in the planting of potatoes on a ridge; but in place of putting the strings of the grass in the furrows, let them be stretched out on the laps of them. One string is sufficient at one place; and at the end of a string, or where the strings meet, lay a clod or piece of earth, and tramp it in with the foot. When all the plants are thus laid down, give the ground a light rolling.

in them, may be discovered its reproduction and rapid increase. It cannot, therefore, be the effect of weather alone; but, supposing it to be a vegetable, and that its seeds mix with the atmosphere, and are deposited on plants when their leaves are wet with dew, all the appearances are easily solved. And with this accords the fact, that rust is found often in patches, which are again observed to spread and enlarge themselves. Besides, independent of any theory, the facts exhibited above demonstrate, that the growth of rust is regulated by certain circumstances in soil and situation; and, if we remove the cause, whatever the mode of its operation, we shall prevent its effects. The writer of this flatters himself that he has pointed out the leading principles on which all means for lessening or removing this very serious evil must proceed; and in the meantime, would suggest the following general directions.

To lessen the effects of an early attack of rust, early harvesting should, by all means, be encouraged. Winter wheat should be sown in August. On cold, black, clay land, it may be proper to discontinue the cultivation of beans. When wheat follows beans or potatoes, sowing should be delayed till the month of March; and real spring wheat should be employed. All tussilago plants should be rooted up. No poplars, willows, or birch-trees, should be allowed to remain near corn-fields.

25th December, 1811.

REPORT ON VEITCH'S DYNAMOMETER, &c. 249

REPORT OF A COMMITTEE

OF THE

HIGHLAND SOCIETY OF SCOTLAND,

to whom it was referred,

**TO EXAMINE PARTICULARLY, AND TO REPORT UPON A
NEW PLOUGH, STATED TO BE OF AN IMPROVED CON-
STRUCTION, MADE BY JAMES VEITCH OF INCHBONNY,
NEAR JEDBURGH.'**

COMMITTEE.

VISCOUNT CATHCART, Convener.

Colonel ELLIOT LOCKHART, M. P.

GILBERT BETHUNE Esq. of Balfour.

THE Committee having met at Admiral Elliot's at Mount Tiviot, on the 8th July 1808, proceeded to examine the matter referred to their consideration, at the adjoining farm of Harestanes, possessed by Mr Hill.

Q 2

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The first object of their attention was a Dynamometer, made by Mr Veitch, from an imperfect description of the one invented by Regnier, which he had met with in a periodical publication.

This instrument appeared to your Committee to be correctly made, and of sufficient strength to render it particularly well adapted to the comparative trial of ploughs, for which it was intended.

Although Mr Veitch claims no merit for this invention, your Committee cannot help observing, that the construction of such an instrument at his leisure hours, and the having prepared and tempered a piece of steel, so as fully to answer the purpose of ascertaining the practical value of his improvement on the ploughs in use, appears, to them, a mark of genius and industry rarely to be met with, and deserving the notice of the Highland Society.

A sketch of the Dynamometer, with his own explanation, are here presented.

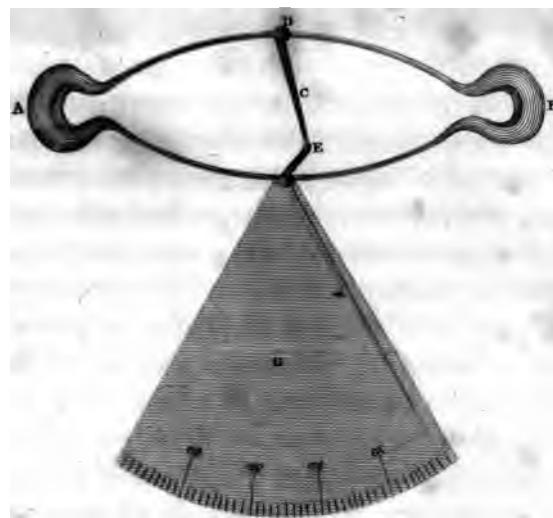
Your Committee, in the next place, examined the construction of Mr Veitch's plough.

An exact drawing of the plough, with references, and a description of the improvements made upon the original and ordinary construction of Mr Small's plough, are added as an Appendix to this Report.

Several ploughs having been collected from those in constant use on the farm of Harestanes, and on neighbouring farms; and Mr Hill, having

to Face Y. 21

SKETCH OF THE DYNAMOMETER. J. VITCH



See 1

VITCH'S IMPROVED PLOUGH



REFERENCE

Dynamometer

Present the two Ends of the Spring.
When Plough and Horses are Yoked.
Small Bar with one of its ends turning
on a Fixed axis D is the other End E Pushes
the Index E which Points out the number
Horse (or 16 lbs) on the Index Plate G.

Plough

AB CD Represent the Sock and Mouldboard of Plough.	Plough
X C The Sock and Fore part of the Sheath.	
XBCYA That Part of the Plough which meets	
The Greatest Resistance.	
X E The Coulter.	
F The Bridle.	
G H The two Plough Stilts.	



een so obliging as to accommodate the Committee with ground in two of his fields, for the purpose of making a trial, two experiments were made in presence of several gentlemen and farmers.

The first was in a piece of tough old meadow ground, where the dynamometer was successively applied to four ploughs, with each of which, two or more furrows were ploughed of 9½ inches by 6, and in the manner which was judged by all the farmers and ploughmen present to be most fair for each plough.

The result was as follows, *viz.*

	<i>Stone of 14 lib.</i>
o. 1. Veitch's improved plough	28
2. A plough of Small's pattern, made at Ancrum Bridge	37 to 38
3. A ditto ditto ditto	37 to 38
4. A ditto ditto made at Long-Newton	34

The second experiment was still more satisfactory, having been made on a field of very stiff soil, and there was more space; so that the soil and hardness of the ground being uniform, each plough had room to prepare its own ground for the trial furrows. The result was—

	<i>Stone of 14 lib.</i>
o. 1. Veitch's improved plough	20
2. A plough on Small's pattern, made at Ancrum Bridge	27
3. A do. do. made at Ormiston	32

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Stone of 14 lib.

4. A plough on Small's pattern, made by J. Laidlaw	27
5. A do. do. made at Ancrum Bridge	27
6. { A do. made at Long-Newton, the same plough as No. 4. in first ex- periment	28
No. 3. having undergone some alteration in the field, was tried again, and found to go easier	30

Length of the Base of the several ploughs.

<i>Feet. Inch.</i>	<i>Feet. Inch.</i>
No. 1. 7 0	No. 4. 6 3½
2. 7 0	5. 7 0
3. 6 3	6. 6 6

These ploughs were drawn by the horses, and held by the men usually employed with them.

The work done by Veitch's plough was evidently neater, and in all respects more perfect than that done by any other plough.

Mr Veitch makes his ploughs himself, with the assistance of a boy, and occasionally of a sawyer. He delivers, upon an average throughout the year, two ploughs per week. He has hitherto made them complete for *2l. 16s.*; but, from the increased price of wood, and of expense of carriage of his cast-iron mouldboards, he cannot afford to continue to make them under the ordinary price of ploughs of Small's pattern, to the best of which they are fully equal in value of materials,

IMPROVEMENTS OF SMALL'S PLOUGH. 247

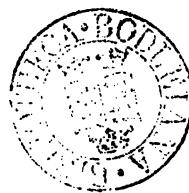
and neatness of workmanship, besides the improvement in construction.

Upon these grounds, your Committee do not hesitate to report, That Mr Veitch's plough is of an improved construction, and that it appears to them highly worthy of the notice of the Highland Society of Scotland.

CATHCART.

W. E. LOCKHART.

GILBERT BETHUNE.



DESCRIPTION

ON THE

IMPROVEMENTS MADE ON THE ORIGINAL AND ORDINARY
CONSTRUCTION OF SMALL'S PLOUGH,
BY JAMES VEITCH.

(Referred to in foregoing Report.)

IT is well known to every practical farmer, that land, when properly ploughed, must be removed from a horizontal position, and twisted over to a certain angle, so that it may be left in that inclining position, one furrow leaning upon another, till the whole field be ploughed.

The form of the furrow which is most approved of by farmers, and commonly to be met with in the best ploughed fields, is in proportion as 2 is to 3 ; or, if the furrow be 2 deep, it must be 3 wide, and left in an inclining position of from 45° to 46° . Various forms have been given to the different parts of the plough by ingenious gentlemen and workmen, according to their different

fancies, in order to diminish the weight of draught, and to turn over the furrow, and leave it in its proper position, without tearing or breaking it, and at the same time to preserve nearly the same form given to this instrument at first ; but, unfortunately, no person has been able sufficiently to accomplish these ends. Mr Small's plough is by far the best that the country has been favoured with these many years ; but the perpendicular position of the sheath, and the too sudden twist of the stock and mouldboard, together with the mouldboard not being of a proper curve with respect to the different resistance that the stock and mouldboard must meet with in ploughing stiff land, render it, in many respects, not so perfect an instrument as could be wished for.

As the stock and fore part of the mouldboard that enters first into the stiff land meets with the greatest resistance, and consequently must wear soonest ;—to remedy this, I begin, for instance, at the point of the stock and bring it a great way farther forward than that of Small's, and by this means give it a more oblique position, which diminishes the angle of the furrow's ascension from the horizontal to the vertical position. The more this angle is diminished where it meets with the greatest resistance, the less apt will the plough be to tilt out of the land, and the more perpendicular the sheath and stock are with respect to the sole of the plough, the less hold will it take of the land ; and it will be more apt to start out,

if the point of the sock be not made to project a great way below the plane of the sole, or point downwards toward the bottom of the furrow. The ploughs that are made in this fashion grind away the point of the sock below; and as this point is so much inclined and removed from a parallel position with respect to the sole of the plough, it increases the friction on that part, and makes the plough a great deal more difficult to be drawn. This parallel position I have preserved in my plough, as far as the strength of cast-iron will admit of; and, as the furrows are laid parallel one to another, I have formed the sock, and that part of the mouldboard where the furrow, by twisting over, is brought to the perpendicular, by cutting away the mouldboard pattern, in parallel lines, from the sole of the plough to the top of the mouldboard; and, by this means, I both procure a steadier motion for the plough, and also diminish the friction, by diminishing the angle; and consequently render it easier drawn, and less apt to break the furrow by a sudden twist.

It is of great consequence, in the formation of a plough, to have the line of draught at right angles to the plane of the horses' shoulders; a circumstance of which the greater part of plough-makers are totally ignorant, although it is well known to every one that has the least knowledge of mechanics.

If we take the angle that the horses' shoulders make with a perpendicular drawn from the horizon, and continue another line at right angles to it, or parallel to the draught chain, the length of this line, from the horses' shoulders to where it meets or crosses the coulter at half the depth of the furrow, will be thirteen feet two inches for ordinary sized horses. If the plough be properly made, the line of draught should pass through the middle hole of the plough bridle, at the point of the beam : this requires the beam (as will be seen by the figure) to be no less than seven feet long, to give it a proper height at the bridle.

This property I have strictly attended to in all the ploughs that I make ; although other people make their plough beams only six feet, and some of them still shorter, which renders them very difficult to be held, and inferior in other respects to ploughs of a proper length.

I have likewise made that part of the plough which goes next the solid land a perfect plane, and to run parallel with the line of draught ; whereas some of the common ploughs are completely twisted in that part, and deviate more than two inches from the line of draught : this throws the plough to the left, and causes the hinder part of the mouldboard to press hard against the furrow, and crush and break it ; and, besides, increases the labour of the cattle.

The position of the coulter cannot deviate

much from the angle of 45° ; for if we were to make it more oblique, it causes the plough to choak up with stubble and grass roots, by throwing them up against the beam: if placed more perpendicular than 45° , it is apt to drive the stones and other obstacles before it, and make it heavier to draw.

ESSAY ON HEDGES.

SHOWING WHAT ARE THE SOILS IN WHICH EACH OF THE PLANTS FIT FOR MAKING HEDGES THRIVE BEST; AND ALSO WHAT ARE THE PLANTS WHICH THRIVE BEST IN HIGH OR EXPOSED, OR IN MARITIME SITUATIONS, AND WHAT ARE THE BEST METHODS OF TRAINING THOSE AS HEDGES FOR ENCLOSURES: ILLUSTRATED BY FACTS AND ACTUAL EXPERIMENTS.

By Mr ALFRED MACLAURIN, Gart-Craig House, near Glasgow.

Mutatam ignorant subtilis ne semina matrem.

THE judicious enclosure of ground is a matter of great importance in rural economy. There are few ways of occupying land in which it will not be necessary, in a greater or less degree, to put it into practice; and in some of these, not the least considerable, it may even be regarded as the foundation on which must be raised every other substantial or valuable improvement. Stand-

ing in such a relation to the first and most useful of the arts, this subject cannot be deemed to be one of little or transitory interest: it will always continue to be deserving of attention; and every inquiry respecting it should be conducted with accuracy and care.

After grounds have been properly laid out and divided, the next point is to introduce the most suitable fences. Of the several kinds of these to which origin has been given by local circumstances, or the different views of possessors, the remarks which follow are to be directed only to one; but that one so comprehensive, as to form, of itself, a multitude. Nature, with her usual liberality, has not limited the materials for hedges to one hue or appearance, but by the production of many plants adapted to this use, has given at once room for selection, and the means of employing them, on various situations and soils. It is our part wisely to improve her gifts, by admitting each plant only into the places suited to its growth; by preferring always the best sorts; and, when any of them have been adopted, by so disposing and conducting them, that they may become in the highest degree useful for their purpose.

1. It is obviously a matter of essential consequence, that the plants to be trained into hedges should be placed upon such soils as may prove favourable to their progress. It is not indeed to be expected, that they can always, or even very

frequently, be confined to that precise description of these which is most entirely congenial with their disposition ; nor would it indeed be easy, in every case, to determine, with all the nicety of which the subject would admit, what is that quality of soil. For though all the soils with which we are acquainted may be resolved into a very few simple elements, yet, as they actually appear in nature, they are so diversified by a multiplicity of minute and often trivial circumstances, ‘ shade so softening into shade,’ that the exact point of distinction between them is not always to be readily observed ; and the superiority of one to another, of course, not with all the accuracy imaginable ascertained. But it happens, fortunately, that such an extreme particularity, as might be often beyond the reach of those who would be most immediately interested in it, and hardly ever applicable to any extent in real practice, is not necessary to the pursuits of agriculture. Few plants are so fastidious in regard to soil, as to require to have it marked out for them with all the delicacy which has been now supposed ; and as to those proper for making hedges in particular, the case is so far otherwise, that they will often flourish upon places, between which, in this respect, even a very broad line of distinction may be traced. It will be therefore sufficient for the present purpose, to specify merely the great outlines of the soils in which these plants, or the most approved of them, have been found most fully to

succeed ; including, in the observations to be made on the subject, not only the more obvious properties of the upper soil, but also those of the inferior strata, which, though not so much in view as the others, may yet have a powerful influence, either good or bad, both on that soil and on the plants to be raised in it. While a delineation shall thus be given of certain determinate circumstances, from the presence of which, so far as they are concerned, the happiest effects may with some degree of confidence be expected, it will not be meant to be understood, that the plants might not thrive sometimes, even as much as could be wished, in others of a somewhat different description. Every one knows, at the same time, how much it is in the power of man, by various means, to alter both the appearance and the intrinsic qualities of soils, so as to fit them for purposes for which they would not have been adapted in their original state ; but the judgment of each individual must direct him, in every particular case, as to the extent to which it would be expedient to undertake that labour.

Among the plants proper for making hedges, none appears better, hardly any so well calculated for the purpose, as that most commonly in use for it, the hawthorn.* This plant, branching out into innumerable ramifications, and armed in all

* The common hawthorn, or whitethorn, *crataegus oxyacantha.*

directions with strong thorns, may be so managed, as, in the state of a hedge, to present a barrier impenetrable to any kind of cattle ; and not, without difficulty, to be passed even by such disorderly persons as might wish improperly to intrude upon the rights of others. Fitted by nature to assume a close and compact texture, which it possesses most fully during the expansion of its leaves, but retains, too, in a considerable degree, after these have fallen, it is not without the advantage of breaking the force of stormy winds; and mitigating the severity of the weather, in favour of the vegetable or animal life which it is appointed to enclose. It is so hardy and patient of direction, as easily to admit of being trained in the manner that may be desired ; and unless there be some defect here, it will retain, in that state of culture, much of its native elegance and beauty.

The first property of a soil fit for the support of this plant, is, that it be considerably rich and fertile. A very light dry soil is not well adapted to it; nor is it likely to prosper much where there is but a very small depth of earth. At the same time, it does not affect the heaviest, most tenacious soils; but may, perhaps as successfully as any where, be raised upon a loam of middle texture, or on an earth of this kind mixed with a proportion of sand. The subsoil ought to be porous, that all superfluous moisture may be carried

away from the roots of the plants ; but not so open as to put them in danger of being deprived of the degree of humidity necessary to their nourishment. If it were needful to state more particularly, on what inferior strata the ground should rest, with a view to the fullest success of plants of this kind, freestone-rock might be mentioned as one of the most desirable subsoils, not only for them, but even for a great proportion of the ligneous tribes. The cleanliness of the skin, and vigour of the thorn, will soon sufficiently indicate the cases in which the plants have been favourably disposed. But if they have to contend with any circumstances remarkably adverse to them, they cannot prosper ; they will speedily exhibit the symptoms of decay, and perhaps die entirely out of the ground; without ever arriving at maturity.

Two plants, scarcely inferior to the hawthorn for the purpose of being formed into hedges, may be named next after it, the *wilding*, or *crab-apple* and the *blackthorn*. These have all, or almost all the same properties to recommend that use of them, which have already been enumerated in the case of the hawthorn. They grow out in a bushy form, with many branches, quite from the bottom ; they speedily rise to a considerable height ; and they have a similar provision of sharp strong spines, fitted at once to prevent the passage of cattle, and to afford to themselves protection from the injuries which they might suffice

from being too closely browsed upon in their leaves and tender shoots. In respect of their preference or power of accommodating themselves to a soil, at the same time, they seem not to differ materially from that plant; as, with it, the ground on which they are to be raised should rest on a dry bottom, whether of earth, or of some kind of porous rock. The soil itself may be a brown loam, of such a depth at least as would admit the operations of the plough. Chalky, sandy, gravelly, clayey loams, so called from the prevalence in them of the several substances from which they derive their names, are also well adapted to the nourishment of these plants. And as they will thrive sufficiently upon fertile clays, they are fitted to fill with advantage a place in which fences of this description are not perhaps so frequently as they might be beneficially employed.

The *holly* and the *yew*, distinct as they are in one obvious respect from the plants which have been hitherto noticed, are not equally removed from them in regard to their choice of a soil. These, plentifully garnished with leaves and branches, and retaining their verdure throughout the year, offer an agreeable prospect at those seasons when the deciduous tribes of plants appear stripped of their vegetable honours. They then, too, afford the best shelter for cattle. Of a close growth, a height fully sufficient for the end in view, and the former well guarded by its prick-

ly leaves, they will be found to constitute a fence certainly substantial, and not easily to be penetrated ; and, moreover, so much to the taste of many persons, as to have been not unfrequently introduced into situations where they were to serve as much for ornament as for use. The soil in which the holly seems to succeed best, is a loam of moderate fertility, or something nearly approaching to it, placed upon such a subsoil, and otherwise so circumstanced, as that its roots may as little as possible be subjected to either of the extremes, both very injurious to this plant, of excessive drought or excessive moisture. It does not dislike rugged grounds, but will prosper very well on stony places, even where there is no great deepness of earth. It ought, however, to be confined chiefly to the least exposed situations, as its progress will be much retarded by want of shelter ; and it is more apt than many others of the plants applicable to the same purposes, to be injured by the force of violent winds. It is a plant, indeed, rather difficult to be raised, and of slow growth ; but it forms a most complete fence, which will last for a great length of time, and which has very little tendency, by engrossing too much, to rob the other productions of the land of their due proportion of nourishment.

The baleful yew, * as it has been called, whether from its sombre appearance or the poisonous

* *Taxus baccata.*

quality of its leaves, is found in great variety of climate and of soil. It appears, however, rather to be widely diffused, than to occur in any considerable quantities together; and hedges formed of it, though sometimes, do not very often, meet the eye of the traveller. Yet, as the manner of its growth † seems not adverse to its being employed for that purpose, so the little fastidiousness of its nature should certainly prepare it for a more extended use. The soil which suits the holly will be also proper enough for this plant: neither of them is, in respect to it, very particular; and the latter is only moderately liable to injury from the atmosphere. ‡ It will degenerate indeed in unfavourable circumstances; but is not by any means one of the plants that are most apt to be entirely destroyed.

Privet, which has the advantage of long retaining its leaves, and is otherwise of such properties as to fit it for being a tolerable fence, is commonly enough, especially in the southern part of the island, to be seen mingled in hedges with the hawthorn. Seeming to thrive very well in such situations, the soils proper for its reception may be considered to have been already indicated, and need not therefore be here repeated.

† This is not to be understood of the time which it takes to grow.

‡ Though 'aquinonem & frigora taxi' would hardly be the proper characteristic in this climate.

The taller varieties of box, though of slow growth, yet when arrived at proper height, form a good and close hedge, which, as in the case of other evergreens, remains in equal perfection through all the seasons of the year. Plants of this kind are not the most limited in their choice of a soil. While they will prosper abundantly in such of them as have hitherto fallen under our view, of some degree of depth and fertility, their progress will not be prevented by their being placed on others of an inferior order; and they may even be found adorning soils too cold and barren for the production of most other vegetables. They will therefore properly stand here, as the connecting link between such plants as have been above enumerated, and those now to be mentioned; which, in respect of soil, or situation, or both, may in general be considered as of a quality more durable and hardy.

In this class may be noticed, first, that species of the hornbeam which grows naturally in Britain,* and which, among other purposes, is cultivated sometimes with the view of being trained into a fence. It loves a poor, stiff, but dry soil; and does not disagree with an elevated situation. It bears lopping very well; and, by a judicious application of this, may be always kept very neat without much trouble. Excellent hedges can be formed of it; and though its shade has been con-

* *Carpinus Betulus.*

sidered to be in some peculiar manner prejudicial to pasture, it will appear in the sequel that opinions of this kind are not on all occasions to be implicitly received, and that satisfactory experiments alone should be suffered to convince us of its being more hurtful in this respect than other plants of equal closeness and magnitude.

The beech † has this property of a good hedge, that it emits numerous branches from the bottom upwards, which, interweaving with and crossing each other at various distances, may certainly be so trained as to form a barrier by no means contemptible either for closeness or for strength. It will grow very well in any dry soil of moderate, and even of rather poor quality. Light, chalky, or sandy loams, on a gravelly or other porous subsoil, will be found particularly favourable to it ; but, except upon a stubborn clay, on a substratum impervious to water, it can hardly be improperly placed, but will go on to perfection even amid rocks, and the greatest scarcity of soil. Hedges of this kind, covered plentifully with leaves of a beautiful green, serve, during one portion of the year, the double purpose of ornament and shelter ; and as these leaves, though with altered appearance, fall gradually away, many of them remaining on even till the new ones are formed, the latter advantage is not lost, when the plants, in respect of their own appearance, or still more of their effect on the surrounding fields,

† *Fagus Sylvatica*.

no longer present a prospect very gratifying to the eye.

Some of the sorts of elm seem to be plants proper enough for making hedges. † In the first volume of the Bath Papers we find them recommended for this purpose ; and it is said that, if managed with care, they may even be formed into fences almost impenetrable. The kind of soil which has been just mentioned for the beech, will be also suitable for these plants. They are, like it too, patient of variety, so as neither to be injured by something more than the necessary degree of humidity, nor to find a want of nourishment even on the bleakest hills, where nature appears in the garb only of wildness and sterility.

An ill founded prejudice, taken up in regard to the barberry, || might well be sufficient to have proscribed the use of it as a fence. This plant, of sure and ready growth, may be convenient sometimes for filling up gaps in thorn or other hedges, where quicks of their own kind, choaked and deprived of nutriment by the older tenants of the soil, would be more apt to die away before coming to be useful. Rising to the height of eight or ten feet, and divided into many stalks and branches, protected every where by spines, it is fitted also to form a pretty good hedge of itself, which has at least this advantage, that it may be raised on grounds too poor and arid for

† Thus, the small-leaved English, and the minor or upright elms.

|| *Berberis vulgaris.*

several other of the plants applicable to the same use. From some cause, however, it is difficult to say what, an idea began to be entertained that this plant was of so baneful a quality as to prevent the filling of corn growing in its vicinity ; and, that credulity might be exerted to the utmost, it seems even to have been considered, that its virulent influence extended itself to the distance of some hundred yards from the place where the plant was situated. It is more wonderful, that an opinion, so very destitute of probability, should ever have gained ground, than that, upon inquiry, it should be found to have been carried to an extravagant length, or even to be altogether erroneous. Its utter † fallacy seems now to have been ascertained by the result of repeated trials, in which grain, raised on places immediately adjoining to hedges formed of this plant, and also on others at different distances within the supposed sphere of its operation, was not observed to have sustained, in consequence, any injury.*

Among the other plants which will in a tolerable manner serve the purpose of making hedges, and are not unfrequently applied to it, may be mentioned the common hazel. † It is of hardy constitution, and quick growth. The soil which it appears chiefly to affect, is a light black loam, on a dry subsoil of gravel or sand. But it is of

* It is presumed that conclusions, directly opposite, must now be drawn, from the latest experience and observation.

† Farmer's Mag. Vol. III. p. 174—5. † *Corylus avellana*.

an easy and tractable nature, and may, with success, be introduced even into places where there is a considerable barrenness or want of soil.*

The property of thriving on poor grounds, just attributed to the hazel, is still more remarkably possessed by the birch. Agreeing in its preference of a soil generally with that plant, it may at the same time be with safety placed in a variety of different circumstances. It will prosper on dry gravel or sand, where there is but a very scanty portion of surface : moorish or mossy grounds also afford it an adequate nourishment ; and it will succeed on moist land of any other description. It is no indeed to be supposed, that the progress or perfection of the plant will, in each of these cases be the same : but as there seems to be hardly any soil so bad as to be absolutely incapable of supporting it, and few on which it may not be turned at least to some account for hedges, its utility in this view may be readily perceived. It can be employed for forming them where otherwise hardly any hedge could be raised ; and possibly might have been often so used, were it not for an opinion, certainly not founded in truth, that its presence is, in some particular manner, hurtful to pasturage. It is, by one part of its character connected with a class of plants, some more of which may be now mentioned, that will be found

* The hazel will generally be found growing naturally in rather a good soil, and sheltered situation ; as on the banks of rivulets, in dells protected from the effects of high gales of wind.

useful on grounds too wet for the admission of other sorts of hedges.

One of these, the Alder, a plant of the same genus † with the birch itself, flourishes best in low marshy places, or by the sides of brooks, where its roots are liable to be washed by the water. In such situations, it may easily be carried to the height of twenty feet or upwards, and trained into very thick close hedges, which no animal will injure by preying on the leaves. It would succeed on dry grounds ; but there, from its eagerness for moisture, it might deprive of their necessary food some of the other plants in its immediate vicinity.

The Common Elder ‡ is a very hardy plant, which will grow freely any where, and, among others, in places where there is a superabundant humidity. It attains to a good height, and is, in these respects, also adapted for a hedge, that it sends out, from the bottom, several strong jointed stalks, which are subdivided into many branches, and that the whole receive considerable additions to their length and strength, even in the course of a single year.

Some of the species of Poplar may be formed into tolerable hedges. The best fitted for that purpose are perhaps the White § and the Black, || which, though they will prosper also on other grounds,

† *Betula.*

‡ *Sambucus nigra.*

§ *Populus alba.*

|| *P. nigra.*

seem to succeed best on such as are rather wet, and where there is a considerable depth of earth.

The Willow is a plant of hardy constitution, and remarkably quick growth. Most of the species prefer, to all others, low, watery situations ; though without being so entirely confined to these, that they may not frequently be raised on pretty dry, particularly if rich soils. Indeed, in any case, a great profusion of stagnating water seems not to be either necessary or beneficial to them ; and it may even be of advantage that their roots be able to penetrate through the moist matter nearer the surface, to sound, firm earth below. In the choice of them for hedges, those species are to be preferred which have the straightest and least brittle shoots, and which most speedily arrive at a competent degree of strength and firmness. They may be usefully employed for dividing extensive fields of clay or other rich grounds into separate enclosures ; but their value will be especially experienced upon land too soft for the reception of any but the aquatic tribes.

In addition to the plants proper for making hedges which have thus been enumerated, abundantly more might be named, such as, the Common Lime and the Evergreen Oak, which may be particularly suitable where it is an object to have very tall hedges ; the Laurel, the Phillyrea, the Alaternus, the Laurustinus, &c. which have often been made to take this shape in gardens

and other such situations, in the design of concealing certain defects, or of adding to some imagined beauty ; with a long list of others, such as the Robinia, an elegant native of the northern parts of Asia ; some of the species of Cytisus, the lilacs, and the rest, whether of the tree or shrub kind, which, however seldom used in the formation of hedges, may be concluded from analogy, and partly too from experience, to be in a greater or less degree adequate to that purpose. † But it has been judged unnecessary to lengthen out this paper, by a detail of plants, which, either thriving in no different situations, are of inferior excellence for the end in view, and less fitted for general use in it, than some of those which have been already mentioned, or, still more, in regard to which, as having been rarely, or not at all actually so employed, little certain information in this respect could be conveyed.

2. It will accord more with the present design, to attend now a little rather to some of the

† The Lime-tree is found, in its most perfect state, in deep, subhumid loams. As a hedge, it is subject to the great defect of becoming, after having stood a few years, very thin at the bottom. The Robinia (*Caragana*), growing naturally in a sandy soil mixed with a black light earth, on the banks of such rivers as the Oby and Yenisei, may be expected to succeed best in other circumstances the most nearly resembling these. It must particularly be kept out of moist ground, and such as has been newly manured. The rest of these plants will, in general, thrive sufficiently in any common soil and exposure.

other circumstances, which, as well as the soil, are found to have an influence on the growth of the plants usually formed into hedges. Two of these are of particular importance,—the degree of elevation and consequent exposure of the lands on which the plants are to be raised, and their state in point of vicinity to the sea. It is well known, that, on high grounds, and in maritime situations, there are experienced obstacles to the progress of vegetation which do not occur elsewhere. Whatever difference of opinion may have existed as to the causes of this in particular instances, the general principle cannot well be controverted, though it may sometimes have been stretched rather beyond the bounds of truth. Thus, to imagine that the great want of trees and shrubs in the Highlands and Islands of Scotland, is entirely owing to the elevation of the lands in those parts, or to their contiguity with the sea, would be evidently improper; as, from the numerous remains still found even in the most barren spots of that division of the country, it is put beyond doubt, that it must, in former times, have been well replenished with wood. The success which has attended such plantations or detached trees, as it has been attempted more recently to rear there, some of them in places where the greatest danger might have been apprehended, at the same time clearly evinces, that no insuperable impediments have since been thrown in the way, to say nothing of the extensive forests which,

in other parts of the world, are to be seen both in considerably elevated situations, and on the very margin of the sea. The question, therefore, as with regard to other plantations, so particularly in respect of the introduction of live fences into such places as these, is not, whether any of the plants adapted to that purpose will succeed in them at all, but what are those plants that will succeed best, and which ought, therefore, to be preferred for them. The better to determine this matter, it will be proper to advert separately to the supposed situations, and to consider what is that evil in each of them, against which it will be necessary to provide.

The circumstances in high grounds which chiefly may be judged likely to retard the course of any kind of vegetation, are the lightness or ruggedness, or the want of soil, the exposure to great degrees of cold, with the prevalence of stormy winds, and the presence of some of those mines * which are known to be so injurious to the various orders of plants, and not least to such of them as are proper for being trained into hedges.

This last is an obstacle *sui generis*, and occurs in such a degree as to be hurtful in comparatively few places. Where it does exist, it cannot easily be lessened or removed; and nothing remains but to seek compensation for the barrenness of the surface, by turning to account the minerals themselves, which rob it of its fertility.

* As of iron, lead, copper.

Where cold and strong winds are the only adversaries to be dreaded, and the soil is considerably rich and nutritive, some of that description of plants which, in the preceding part of this paper, were first noticed, may be successfully introduced into it. Thus, the hawthorn itself is sufficiently durable and hardy; and when it has once settled firmly in the ground, and arrived at some degree of strength, will bear, without injury, very considerable degrees both of cold and wind.

When, in addition to the rigour of the climate, the high grounds on which it is wished to form hedges, are also covered with a very thin or barren soil, the place of the plants which have been just mentioned, may be supplied by those others, of which a characteristic was formerly sought in their superior power of resisting these evils. It has already been observed, particularly in respect to several of these, such as the beech, the elm, the birch, how well they will succeed even on the poorest grounds. They are in general, at the same time, hardly less patient of severity of weather; and therefore from among them may, without difficulty, be taken the means of raising hedges, even in the most disadvantageous situations into which it can ever be an object that they should be brought.

If it could be desirable to add to the facilities which thus, from different quarters, present themselves for the enclosure of elevated lands, the

Mountain-ash * and Service † trees, being not easily injured by frigidity of climate, dividing into many stalks and branches, and carrying numerous leaves from the top to the bottom, might be mentioned as seeming to possess qualities which should fit them also, in this respect, for usefulness. ‡ They would answer an important purpose on such grounds, were they to be employed only for affording shelter to those other plants which it might be proposed there to form into hedges. But from every thing that is known with regard to them, there can be little reason to doubt that they might themselves, with advantage, be made to assume the same appearance, and thus, in a new capacity, to become productive of benefit in such situations.

On grounds of this description, too, in which, particularly, the soil is very steril and coarse, still another species of hedge might be raised, which it would be less proper to admit into any of a different quality. This is one formed of furze, a plant of very speedy growth, and which might quickly become useful as a fence, but, from the weakness

* *Sorbus aucuparia.*

† *S. domestica.*

‡ In Anderson's Essays on Agriculture (vol. II. p. 16, &c.), the Service is mentioned as a plant fitted to be of considerable use in protecting hedges from the severity of the storm. The obvious objection to the kind of fence, in connexion with which he proposed to use it, is the expense.

of the individual stems, and the gradual decay of its lower and first formed prickles, requiring, with that view, to occupy a greater breadth of ground than is necessary for other hedges. This loss of ground, with the farther inconvenience of the plant being so much disposed to spread itself through the adjoining fields, will always be strong objections against the introduction of it into lands capable of bearing a better crop. But in others of comparatively little value, the space that will be taken up with this sort of fence can be an object of but small consideration ; and as the plant affords a nourishing food to various orders of domestic animals, that part of such grounds may in fact be rendered the best and most useful to which the furze has chiefly extended itself. †

The obstacle to the growth, especially of the larger kinds of plants, which is observed in places in the immediate neighbourhood of the sea, seems, by one part of its character, to be closely connected with the evil to be apprehended for

† Directions for forming hedges of this plant may be found in Anderson's Essays on Agriculture, the Gentleman Farmer, &c. The objection to the use of it from its overrunning the ground, may be in a great measure removed by means of French seed, which, seldom ripening in this country, is not so liable to that inconvenience. Though hedges of this kind might be carried to a considerable height, there would be no utility in so training them, unless mixed with other plants which might increase the closeness of the texture below.

them on exposed situations. The wind, increased and chilled, as it must be, by passing over a vast expanse of water, cannot be harmless to such plants at least as, from their magnitude, oppose any considerable resistance to its progress. In addition to this, it is well known that the sea-spray is often carried, in stormy weather, even for miles, across the adjacent country; and it is certainly no unreasonable idea, that air impregnated with salt particles may be hurtful to many kinds of vegetables, and prevent them from reaching the perfection which otherwise they might have attained. The danger to be encountered, therefore, by plants raised in maritime situations, is to be considered as of a compound nature; and proper precautions should, in each respect, be taken against it. So far as the winds and the cold are concerned, such places may be properly classed along with those to which our attention has just been directed, and several of the observations made with regard to them transferred also to these others. But if it be understood that the sea-water possesses a principle unfavourable to vegetation, which is peculiar to itself, and which fastens, with various degrees of malignity, on different orders of plants, this will not be sufficient. It will be necessary farther to consider, what plants chiefly, proper for making hedges, have been actually observed flourishing and coming to maturity in the vicinity of the sea. This circum-

stance will be decisive of the point, whether or not, and how far, they will, in whatever way, be injured from that quarter; which being determined, it will only remain to dispose of them, according to their preference of a soil, or to other properties known to belong either to them, or to the grounds on which it is meant that they should be raised.

Of all the plants usually formed into hedges, the most patient of the influence of the sea is undoubtedly the *Elder*. The other properties already mentioned of this plant, prepare it for being very generally useful in contending with that difficulty. And, from these circumstances together, it may frequently be proper to prefer hedges of this kind to others, which, considered merely as fences, would no doubt be greatly superior.

The Great Maple, * or, as it is commonly called, the Sycamore, and the Norway Maple, † are plants also distinguished for the success with which they resist the spray of the ocean. These have not, it may be, often, perhaps almost never, assumed the form of a hedge; nor is it meant to be said that they are very well adapted to that use. In places bordering upon the sea, it should seem, however, that they might be turned to some account, if not in forming fences entirely of themselves, yet, by being mixed with, or placed

* *Acer pseudoplatanus.*

† *Acer platanoides.*

behind other plants, in securing them from injury, and permitting them to proceed unmolested on their course.

The like benefits might be derived occasionally from some of the Pine tribe. The Scotch Fir, * as it is usually called, may be raised successfully even on the sea-beach, and in apparently barren and unprofitable sand. † The Pineaster seems not more liable to injury from the sea, and has been found to prosper where the Scotch fir would not succeed. ‡ By their numerous leaves and branches, they are both well fitted to yield security to other plants placed under their protection; and, though certainly not so eligible as could be wished for being themselves trained into fences, yet instances may sometimes have been observed of cone-bearing plants assuming a firmness and closeness of texture not wholly disproportionate even to that purpose.

Among the rest of the plants more commonly cultivated for hedges, those have one advantage for maritime situations which are the best able to sustain the force of violent winds. They appear, at the same time, not to be in other respects the worst calculated for them. It is sufficiently known, that beech, elm, and other such plants little liable to be injured by exposure to the wea-

* *Pinus sylvestris.*

† *Beauties of Scotland*, vol. I. p. 431, 2.

‡ *Ibid.* vol. II. p. 414.

ther, are to be seen thriving both in the state of hedges and of detached trees or shrubs, on the verge even of the ocean, where each of the dangers to be apprehended from the vicinity of the sea must be in the strongest manner experienced.* It is not, either, in the case only of the plants which have been joined along with these, that some degree of success may be here expected. Copses, or regularly formed hedges of hawthorn, crab-apple, black-thorn and the like, in apparently not an unprosperous state, may be traced also along the coast.† And willows, and the plants connected with them, are not without their place in such situations.‡ But to fix the order in which all the plants before enumerated, or others applicable to the same purpose, should be arranged, according as they prosper more or less in maritime places, a particular set of expe-

* As on the shore of the German Ocean, in the woods between the mouth of the Tyne and North Berwick; *Beaut. of Scotl.* vol I. p. 431, 2. Beech is a prevailing wood on the shores of the Baltic; *Küttner's Travels*, Let. 1. & 3. In the island of Harris, no part of which can be very far removed from the influence of the sea, hazel was found to succeed particularly well; *Knox's Tour in the Highlands*, p. 160. And very generally, in the same quarter of the world, pretty considerable arms of the sea are found fringed by the birch; *Ibid. passim*, &c.

† This is the case on the coasts both of Scotland and England.

‡ *Beaut. of Scotl. ubi sup.*

riments would be necessary, for which the writer of this paper has not had opportunity since the subject attracted his attention, and which he has not learned to have been made by other hands. To any person who might have leisure and convenience for the inquiry, it seems deserving of attention; and it could be prosecuted without much trouble. The chief object would be, to provide that, during the trial, the plants should, in every thing unconnected with it, be all alike well disposed, agreeably to their respective natures, that consequences might not be attributed to one cause which had in reality proceeded from another. In defect of such experiments, it has been necessary here to stop short with the bare indication of a few sorts of hedges which may be raised successfully in the neighbourhood of the sea. Of the whole of the plants that may be applied to that use, some it might be expedient, or even essential, to protect, by other plants, from its influence; others, though they would continue to live, might appear, in such circumstances, rather blasted on one side, and stinted in their growth; and for all of them, especially those most liable to injury, it will be proper, as in every other exposed situation, to secure in their favour every defence which can be derived from the manner of originally laying them out in the ground, or from the subsequent care of them.

3. If plants be placed in a situation and soil proper for them, and there be nothing, either in

the earth or the atmosphere which surrounds them, peculiarly hostile to their growth, they have received every thing that is necessary from nature to their progress, and, with very little of the assistance of man, will without doubt arrive at the perfection of their several kinds. But more than this is required, that such plants may become useful for hedges. With this view, they must be disposed, in the beginning, in a manner suitable to that purpose; they must, by continued guidance and direction, be trained into and kept in a certain determinate form; and when, from any cause, they have begun to decay, means must be employed for reinvigorating their strength, and giving to them anew the freshness and the health of youth.

The first thing in the management of hedges, is to prepare the ground aright for their reception. In doing this, it will be always of the highest importance that the places on which they are to be raised should be beforehand completely cleared of weeds, and thoroughly pulverized. The richness of the soil, it may be useful also in some cases, and with respect to particular plants, to increase by manures; which should be laid on, for that end, at the time when, the ground being clean and well comminuted, they would most entirely mix with it, and render it the greatest service. It is unnecessary to say how beneficial would be the effects of such treatment on the growth and luxuriance of the hedges. But there may be many

occasions, when, from the natural situation of the grounds, or some other cause, very little of this sort of culture can be bestowed. It is therefore indeed fortunate, that plants may be found which will thrive tolerably well with but a very scanty share of this preparation ; though, with regard even to them, and in every variation of circumstances, any pains that are judiciously taken for the previous improvement of the ground, will not appear to have been improperly applied, but receive afterwards entire approbation, when the good consequences are experienced in the increased excellence of the plants produced upon it.

While the general principles to be pursued in preparing the ground for hedges must in every case be the same, the particular application will necessarily vary with the manner in which it is intended that they should be disposed. The most obvious method of laying them out, is to place them on the natural surface of the ground, without any other labour than may be necessary for cultivating well a few feet at least on each side of the line on which they are to be raised. But a variety of reasons will make it proper frequently to depart from this simplest and least expensive mode of forming them. When grounds are wet, it is necessary that they should be drained ; and where open ditches are used for that purpose, these cannot be better disposed of, than by being drawn in a line immediately adjoining,

and parallel to the hedges by which the fields are enclosed. If, in that situation, they can be effectual for the end chiefly intended by them, the incidental advantages will at the same time be gained, that the least quantity of land will be lost to culture; and that the fence, of which the ditch is thus made to form a part, will receive a certain consequent addition to its strength and security. The materials thrown out of the ditch, if not carried away for other purposes, will naturally be moulded into a bank of earth proceeding along the side of it. This will be particularly useful, where any danger might be apprehended from moisture, for raising the roots of the plants intended to become a hedge, above the sphere of its influence. Such a bank of earth may be also of utility, even where there would be little occasion for a ditch, by affording to these plants, on grounds otherwise inadequate to their nourishment, the advantage of an increased thickness of earth. The desire of an awful situation may induce some to place their hedges on the top of this bank; while the benefits of shelter, and of the richer parts of the soil, will cause those of others to proceed obliquely from its sides; and the wish to unite these latter advantages with that of a freer communication with the sun and the atmosphere, may lead a third party to form a separate bed for their plants, on the same, or on the opposite side of the ditch. It may conduce both to ornament and strength, in raising the mound

of earth, to cover the sides of it with green turf. And it may be attempted to join, in some degree, the solidity of the wall to the beauty of the hedge, either by making it rise from earth enclosed within two facings of stone, or by placing a small dike upon the top of the bank, from the side of which it grows. To detail particularly the operations, which, with a view to each of these objects, must be undertaken, or the benefits which they may have been considered severally to afford, would far exceed the limits of this paper. It may be sufficient to observe, that the points always to be chiefly attended to, are, that the roots of the plants have access to such a depth of good and well cultivated earth as may be necessary to their vigorous growth—that either above, or below, they be not too much secluded from the benign influence of the air and rain—that no obstacles, or as few as may be, be thrown in the way of their successful progress—and that those which Nature may have interposed be as far as possible removed. The circumstances of every situation should be taken into the account, in determining what is to be done in order to its being provided with proper hedges; and while, in some cases, enlarged expense, and additional loss of ground, (a matter of some consideration where land is valuable), cannot well be avoided, in other instances they may certainly be spared, when, by being incurred, it does not appear that there would be gained, in consequence, any great or proportionate advantage.

The materials from which hedges are to be formed, may vary according to the nature of the kinds. Some of them, it is usual and most proper to raise only from seedling plants, or from the seed itself; * others may be more successfully derived from layers or from suckers; and others still more so from cuttings, or mere branches, or parts of branches, of some shrub or tree.

When seedlings are to be used, those only are to be employed which are adapted to the nature of the soil, recently taken up from the place in which they had been nursed; straight, smooth, with large and well-formed roots, and altogether of a good size in proportion to their age, which may generally be from three to five years. † The

* Instead of seed, the young plants to be used may be raised sometimes from parts of roots, or from chips of green timber. This last method has been recommended particularly in the case of the elm; it being understood, that the plants raised in this manner, ‘ without tap-roots, and shooting their fibres horizontally in the richest part of the soil, will be more vigorous, and more easily and safely transplanted than if raised from seeds, or in any other way. They have also greatly the advantage for fences, as five, six, or more stems will arise from the same chip; and, if cut down within three inches of the ground, will multiply side-shoots in proportion; and make a hedge thicker, without running to naked wood, than by any method yet practised.’

† In respect to the age and size at which plants intended to be formed into hedges should be taken from the nursery for that purpose, agricultural writers are far from being agreed. It seems however to have been ascertained, from ex-

necessary number of such plants having been got together, the ground is to be regularly opened for them along the line on which they are to be placed—their roots fully extended to be covered over with the earth—and the upper soil drawn closely and compactly about them, that there may be the least delay to the vegetation, and as little room as possible for the admission of any thing that would be hurtful to it. After they have been fixed in their several places, it will be proper to cut them over within a short distance of the ground, by which means they will not be so liable to be thrown into disorder by the force of violent winds. They will strike root the more vigorously, and their growth in every respect be considerably promoted.

It has been recommended, in the case of some of the hedges commonly raised in this manner from seed, that this seed itself should, from the beginning, be sown in the places destined for them, rather than that the young plants proceeding from it should be afterwards removed. † The

perience, that the greatest success, and especially the most speedy progres, is to be expected, where rather young plants are employed. Presenting the smallest surface to the wind, and with roots larger for their age than those of other plants, they seem also particularly suitable for places that are in any degree bare or exposed.—*Nicol's Practical Planter*, p. 76. 270, &c. 2d edit.; also chap. 4. § 2.

† This has been proposed for hedges of holly and black thorn. It is the usual, and apparently the only proper method, of raising whin hedges.

chief advantage which seems to have been expected from this alteration, was, that the plants would, in consequence, proceed more quickly to maturity. How far this advantage is real, can be ascertained only by those who have had opportunities of observing the comparative progress of hedges raised in these several ways. But, without that, it may be safely affirmed, that, even with the supposed superiority, a tolerable fence can hardly be so early obtained from the seeds, as from plants put into the ground at the same time. In the sense in which chiefly speedy progress is an object of desire, it may with reason perhaps, therefore, be contended to belong at least as much to the latter, to say nothing of the greater probability which there is that the seeds shall ever grow at all, when laid out on one well chosen place, where they may be under constant observation, than where they are to be carried along a large extent of ground of various quality and exposure, and left to make their own way with a comparatively small degree of care and attention.

The manner in which layers, suckers, and cuttings are to be planted for hedges, differs not, in any material respect, from that which has been now described. These are all used of different age and appearance; but it is, in general, most proper that they should be of few years' growth, rather slender, and at planting not left of a great height above the surface.

As to the distance at which plants set with the view of becoming hedges ought to be placed from each other in the row, there is room for difference of opinion. Some, considering that the strength of every hedge lies chiefly in the upright stems, may be disposed to train up as many of these as nearly to touch each other; while others, afraid of their hedges becoming too bare below, may rather approve of their being held at a greater distance. Much ought to depend on the magnitude of the plants and the length of their branches.* The greater or less degree of fertility in the soil should also be attended to. But, on exposed situations particularly, a more than ordinary closeness will be necessary, that the plants may aid each other, in bearing up against the peculiar difficulties which they will there have to encounter. †

The time for planting will depend upon the kind of hedge, and the nature of the ground on which it is to be raised. On dry, elevated parts,

* The differences, in this respect, are so considerable, that while the common thorn hedges have their stems separated from each other no farther than from about 6 to 9 inches, an interval of as many feet may be allowed for those of elm.

† In such situations, were it not for the expense and loss of ground, it might be useful, instead of one, to raise two or even three rows of hedge-wood; which, besides thus protecting each other, would afford mutual and material advantages on occasions of repair.

deciduous hedges ought to be planted in the autumn or beginning of winter, that, receiving the benefit of the winter rains, they may forth such fibres early in the spring as may enable them better to bear the summer drought, pernicious to plants newly inserted into dry and on high situations. Where the ground is moist and cold, and there would be a danger from its humidity, of the plants being thrown off in severe frosts, the operation will more properly be deferred till the spring. In this season, the evergreen tribe also may be set just before their beginning to vegetate; or perhaps, as eligible a time for them will be the commencement of the second growth, plants of this kind commonly take about the summer. It should always be an object to do the work when the ground is in a middle state, neither very wet nor very dry; when, of course it may be most easily, and at the same time successfully performed,

For protecting the young plants during the period that they are most liable to injury, the most effectual plan would be, to form two hedges with a mound of earth between them, and to fence on each side by a ditch. By this means the depredations of cattle would be most effectually prevented; and first by the bank of earth, and afterwards by the mutual good offices of the hedges themselves, the bad effects of cold or very

winds would be lessened or destroyed. † The same advantages may be obtained, in a great measure, even where the expense of one hedge and ditch is avoided, by placing behind the hedge which is left, a dike, paling, or dead hedge, of sufficient strength and firmness: Or these latter alone may be adequate to the purpose, where there has been provided no other security.

After a hedge has been disposed aright in its place, and the necessary precautions used for its safety, the object to be next particularly attended to, is, that the ground on which it is situated be constantly kept as clear as possible of weeds; and that, in other respects, it receive regular and due cultivation. Where there are ditches, these should at fit times be scoured, and the rich stuff obtained from them applied to the roots of the plants. Where there are none, or but very shallow ones, much incidental benefit might be derived to the hedges, were meliorating crops sometimes raised in the fields immediately adjoining to them. The care of the ground is not to be laid aside at any period of the growth of the hedge; but least of all should it, in respect of

† It deserves notice, however, that hedges formed in this way have begun to be disused in some parts of the country, from their not thriving so well as single hedges.—*Beauties of Scotland*, vol. II. p. 86. This will happen, wherever there is a defect of nourishment, one healthy plant being better than two weak or abortive ones.

any one description of plants, as is too often the case with those of the aquatic kind especially, even from their infancy neglected.

It is towards maintaining, in a proper state the soil on which hedges are planted, that the pains employed about them during the first year of their growth, ought alone or chiefly to be directed. It is not necessary, and might even greatly prejudicial, to begin to lop or shorten them at too early a period, or to interfere in any way with their natural course. If, indeed, they be of a kind that is very much disposed to run naked wood, there may be occasion to cut them over both the sooner and the oftener, to encourage the growth of lateral branches; † but where the case is otherwise, and the plants continue to thrive, any thing of this sort should be longer delayed, even if it should ever require to take place. The effect of a different management might indeed to elicit a greater number of shoots from the parent stems; but the danger is, that more of these being put forth than the roots would be able to maintain, they would all continue weak and puny, and never attain vigour to render them useful for their purpose; whereas, if the plants were allowed for some time to proceed in their own way, either without being lopped at all, or but very slightly on the sides, they would more probably produce in each season no more

† Provided always they be plants which will bear to be lopped in this manner.

shoots than could receive sufficient nourishment; the number of these would be increased as the plants advanced in age; and, at a fit time, a rich fund of materials would be presented, ready to be moulded into that form which mature consideration might most approve.

It has been too much the practice in this country, in the training of hedges, to raise them in a perpendicular line from the ground; or, rather, it would appear sometimes to have been an object, that they should bulge out, and become broader at the top than at the bottom. It is obvious, that the accumulation of leaves and branches thus made above, must exhaust a great deal of the sap, which might otherwise have supported a vigorous vegetation elsewhere. The head, becoming gradually larger, excludes more and more the lower parts of the hedge from the benefits of the sun, air, and rain. These, deprived so of every thing necessary to their healthfulness and increase, send forth few young shoots, and have as little addition made to the growth of those which they had already produced. They, in short, become little else than channels to convey the nourishment, received from the roots of the plants, to those other parts of them, where alone there is any room for, or appearance of vegetation. Whence, with extended bushy tops, which can be only useless or pernicious, the hedges become so bare and thin below, as to be in a great measure inadequate to the purposes either of shelter or defence.

This striking imperfection very perceptibly shows itself in many of the hedges yet to be met with in the country, even in those of them which in other respects have been the best kept and have had every advantage in their favour which could be derived from situation or soil. It is to be guarded against only by a radical change in the principles of forming hedges. Instead of the top, they should be broadest at the bottom. There they may be allowed a breadth of from two to three feet; but in their progress upwards, this is to be gradually diminished, till at last they are dressed off into a round or edge-ridge, bearing but a small proportion to the breadth at which they originally set out. In this tapering form they may be carried to the height of about five or six feet, which will generally be sufficient for the purposes of an ordinary fence; but where any thing particular is in view, that itself will suggest the difference in the height which ought to take place.* Hedge

* From experiments stated in Lord Kaines's Gentleman Farmer (p. 280, &c. 3d edit.), it is there concluded, that the most advantageous method of raising hedges, so as to cause them at once to acquire strength of stem, and retain the closeness below, is not to cut off their tops till the stems have become five or six inches in circumference, which may be 10 or 12 years. In the mean time, to dress them to the height at which they are to stand, in the usual manner;—to allow the stems to grow up above this height till they have attained the necessary thickness, but without any such branches

conducted in this manner will have all the good qualities to recommend them which are opposite to the defects above stated. The plants will grow alike vigorously in every part; they will, throughout, bear marks of their soundness and uncorrupted state; and their chief defence will be in that part where chiefly defence is wanted.

In pruning hedges, it is usual to lop off the large branches with a bill or knife, but to cut away the smaller twigs with a particular kind of shears. In some of the southern counties of Scotland, however, which give to the other parts of the country the best example in every thing relating to the form and management of hedges, the use of this latter instrument is now pretty generally laid aside, and the operation is wholly performed with the pruning knife. The neatness and expedition with which the work may be done in this manner, by those who have had experience in it, are greater than might be readily supposed. The

might injure the rest of the hedge;—and, when the end has been served for which these had been suffered to stand, to cut them over at the height at which they are to remain. It may be observed, however, that though this principle of training hedges might suit better on grass lands, on such as were under corn it would be apt in different ways to prove injurious. Even, too, before arriving at the usual height, much more at that which has been now supposed, various circumstances in the state of hedges themselves may make it necessary, or proper, that they should be taken down, or shortened, in different degrees.

stroke of the knife, well sharpened and prepared for its purpose, proceeding from the bottom to the top, separates with a clean cut every branch or twig that lies in its way : the successive strokes, guided in exactly the same level, spread a uniformity and smoothness over every part of the surface : and the whole of the hedge, formed upon one plan, throughout regularly and well executed, presents, when completed, the correct and even appearance of a finished piece of masonry. This mode of cutting hedges is considered to be productive of different advantages ; but enough in that respect to recommend it, is what is thus stated by a late writer on the subject. ‘ In pruning a hedge,’ says he, ‘ the bill or knife should be used, as preferable to the shears. They bruise off, rather than cut over the twigs ; and hence, every shorn hedge throws out a great number of small shoots from the surface only, which in time forms a kind of coating or net-work all over the hedge, enclosing the naked stems within, and excluding them from the air. But the knife cuts off the twigs clean and smooth. By this means, they throw out* fewer

* It is difficult to perceive the principle on which Mr Loudon asserts, that hedges cut with shears throw out more numerous shoots than those cut with a light hedge-bill. The shoots from a hedge cut with shears ought to be fewer, as well as more puny, than from one cut with a sharp, light bill ; because, the branches being less injured by the bill than the shears, will be in a more vigorous state to produce them. As

' shoots, but those are of greater strength ; and
' the hedge is equally thick in every part, without being crowded.' †

The materials separated from hedges in pruning need not be lost. The stronger parts of several of them may be useful for some small purposes of husbandry, or other arts ; and the account to which even the more slender twigs can sometimes be turned,‡ should furnish an additional incitement to the cutting of hedges, which, on their own account, it would be improper, though it may be too usual, to let pass without it. The operation may take place once or oftener in the year, according to circumstances ; the time and the particular detail of the business being regulated by a regard at once to the appearance, and to the general success and usefulness of the hedge.

Some of the plants which have been above mentioned, as adequate to the purpose of making hedges, it is obvious, are disposed to send forth rather long pliant shoots, with but very little tendency to assume that close compact form which constitutes the most valuable distinction of the

to number, this must depend on the number of *buds*, (which cannot be supposed fewer in the hedge dressed with the bill, than in that with the shears), combined with the vigour of the branches to push them into shoots.

† Loudon's Observations on Planting, &c. Section 13.

‡ As in the case of the willow.

best of our common hedges. These, of course, if trained in the usual way, could form only very imperfect fences;—the more so, as being of a plain smooth appearance, without any kind of armour for defence, they present nothing to deter any species of animals from approaching or endeavouring to pass them. In such cases, it might be of advantage to adopt the expedient which has been suggested as to willow hedges, of throwing the plants, while young, into a network like form, by crossing them over each other, and fastening them above, by the small twigs plaited together at the extremities. || The common practice in Germany, in respect to the hedges of Hornbeam raised there, § which is not very unlike to this, may furnish also useful hints,

|| Anderson's Essays on Agriculture, vol. 1: p. 54.

§ ‘When the German husbandman,’ says the author of Essays on Husbandry, ‘erects a fence of this nature, he throws up his parapet of earth, with a ditch on each side, and plants his hornbeam sets in such a manner, that every two plants may be brought to intersect each other in form of St Andrew’s cross. In that part where the two plants cross each other, he gently scrapes off the bark, and binds them with straw thwartwise. Here the two plants consolidate in a kind of indissoluble knot, and push from thence horizontal slanting shoots, which form a sort of living palisado, or chevaux de frize; so that such a protection may be called a rural fortification. The hedges being pruned annually, and with discretion, will, in a few years, render the fence impenetrable in every part.’

for such occasions. And a very considerable safeguard may always be derived from placing along the line of hedges, at small intervals, such plants of the rose kind, or others like them well furnished with prickles, as may be best adapted to the particular circumstances and situation.

After a hedge has advanced so far as to be useful, it may be retained in that state for a very considerable length of time. Even, however, though managed with care, but much more if neglected, it cannot be expected to continue always alike fit for its purpose, but is subject, in various degrees, both to a partial and a general decay. It will be a matter of no slight importance to counteract, as far as possible, the disorders to which fences of this kind are liable, and to meet them with prompt and effectual remedies.

While a hedge remains in a pretty vigorous state, branching out well below, with all its stems in their places, any irregularities above may be corrected by little more than ordinary pruning. If it be everywhere very scantily provided with leaves and branches, yet its stems retain full health and soundness: it may commonly be recovered by cutting entirely away that thinly scattered growth, and leaving only the stubs to produce a new vegetation. If even these have begun to fail, the whole hedge, or such part of it as is in that state, must be taken down to within a

few inches of the ground ; nothing being suffered to remain but so much of the old stems as may yield the rudiments of another to supply its place. The stems should be cut obliquely and smoothly across, to prevent the lodging of water ; and, by choosing the proper time for the work, and otherwise taking care, to lacerate or injure them as little as possible.

If there be gaps in hedges at the time they are so far gone as to require in this manner to be cut down, an opportunity will now be afforded of filling them up. Some of the most vigorous plants of the proper kind that can be had, may be put into the empty places, which will grow up along with the shoots from the old wood, and form altogether a hedge, to be managed quite in the same manner as one proceeding entirely from young plants.

Where the gaps are not very large, and there remain, or have been produced anew, sound branches sufficient to be carried over them, these may be made in different ways to supply the place of any distinct plants, and even with a greater certainty of success. By being led horizontally along the vacant spaces, and fastened down at the extremities till they naturally take that direction, they will put forth such numbers of perpendicular shoots as will speedily take the appearance of a hedge, which will constantly be receiving additions to its strength. Or if the

tender shoots be bent downwards to the earth, and laid † so as to give origin to new plants in the places where they are wanted, these, still connected with their parent stock, will undoubtedly advance to maturity, with a degree of vigour hardly otherwise to be obtained.*

The quickness and certainty of growth to be expected from these last ways of repairing breaches in a hedge, will make them peculiarly suitable, in the case of such gaps as may have arisen in hedges otherwise in sufficient order. If the intervals be so wide that they cannot thus be filled up, recourse may be had to dead wood, or to such living plants or cuttings as are found to succeed best in shady and confined situations.‡ The principle is also known of using only plants of the same kind, whatever it may be, with those

† This is infinitely the best mode of repairing gaps; but the soil ought to be dug over, and cleared of weeds, and of the roots of the plants of the hedge that may be in possession of it at the time. The soil in which the layer is to be placed, should also be mixed with some *fresh* earth, *not dung*. The gap must also be protected from the intrusion of sportsmen and their dogs, and above all from hares, (which last will otherwise continually eat down the young shoots), till they acquire sufficient strength to set them at defiance.—A staked palisade is the only protection.

* These methods of repairing ruinous hedges are recommended in the Annals of Agriculture, (vol. 7.) and seem certainly preferable to the practice of plashing.

‡ Crabs, sweet-briar, willow, &c. have, however properly been proposed for this purpose.

in the rest of the hedge, but equal to it in height, or of a smaller size, and secured from the injuries to be dreaded in such circumstances, by cutting down a small portion of the living hedge on each side of them. The defenceless parts are in every case to be protected by some temporary safeguard ; ‡ and fit means used, that that which is to come into its place may as speedily as possible assume its proper capacity of more permanent usefulness.

It is obvious, that any general observations on things comprehending many subdivisions, cannot commonly be applicable to each of these in the same degree. It may, however, without much danger of contradiction, be affirmed, that hedges form a fence strong, serviceable and lasting. Instead of being at their highest perfection in the beginning, and thence proceeding gradually to decay, they are some time indeed before they are fully adequate to their purpose ; but then they serve it effectually ; are daily becoming better ; and even when they begin to fail, may in general, without much trouble, be restored, and put anew into the progress of increasing utility. They may usually be raised and maintained at less expense than other fences of nearly equal value or duration : And, far from the dead appearance of a wall or palisade, their continuing, or

‡ The Common Dog Rose is infinitely preferable to Sweet-briar, being a much stronger and hardier plant.

annually renewed verdure, even adds beauty to a landscape, and presents an agreeable and inviting object to the eye of every beholder. It would be singular, if, with so much to recommend the use of them, nothing could be found to object to it. Such objections have accordingly been made; but these not numerous or important; and indeed applicable rather to neglected hedges than to such as have been always kept in due order. It were certainly therefore desirable, that in many places well adapted for their reception, fences of this kind were more frequently introduced. It would be of still greater consequence, if, in the places where they are, proper attention were always paid to their preservation and culture. They are a convenient resource in every situation; and the facilities which they afford for enclosing grounds at a distance from the more bulky materials of other fences, should bring them into favour, even with those by whom, in general, they are least approved.

ESSAY

ON THE

BEST METHOD OF CONVERTING HEATH, OR HEATHER,
ECONOMICAL USES, SUCH AS FOOD FOR CATTLE,
TANNING LEATHER, AND OTHER USE-
FUL PURPOSES.

By Mr ARCHIBALD MACLAWEIN.

Minutula pluvia imbre parit.

HEATH is a plant too well known in this country, to require any particular description. It shoots forth spontaneously over large tracts of ground; and is found in various situations and soils. The differences, in these respects, to which it may have been subjected, are accompanied, indeed, by suitable variations in the appearance and degree of perfection of the plant: but its general character is, in all cases, the same. It is of t

Monogynia order, belonging to the Octandria class of plants. It strikes deep roots ; rises to the height, sometimes, of two or more feet above the surface of the ground ; begins to vegetate yearly towards the end of May ; and puts forth its blossoms in July or August. There are four species of it known in this country, distinguished by suitable characteristic properties ; but of these it seems unnecessary to speak, in a place where it is proposed only to give an account of some qualities, belonging, in a greater or less degree, to each of the varieties of it.

Though it would certainly not be deemed adviseable to bestow much labour on the culture of this plant, or to endeavour, by art, to introduce it into places in which it is not naturally found, yet every one must admit, that, where it rises of its own accord, every advantage of which it can be made productive, ought to be derived from it. If the grounds on which it appears can be advantageously applied to the raising of other more valuable crops, this, indeed, will afford a proper and obvious inducement for as speedily as possible extirpating it from such situations. But, till that can be done, or where insurmountable obstacles stand in the way of any such improvement, prudence requires that the smaller benefits to be reaped from the natural production, should not, in the mean time, be neglected.

The uses to which heath has occasionally been employed by the necessities or art of man, are

numerous, and of very different degrees of importance. Sometimes it has been made subservient to ends for which it would never have been thought of, except by a rude or poor people. In this light may be considered the application of it to such purposes as the formation of the walls of cottages, or of beds for their wretched inhabitants. Some of the purposes for which it has been used are of so obvious a kind, as could hardly fail to be suggested by the slightest knowledge of its nature; and admit not, for the most part, of any considerable improvement in after practice. Of this kind may be reckoned the employment of it as a fuel for heating ovens, or for common use,—the several domestic purposes to which it has been applied,—and the end which it serves, by affording materials for thatching. In some other applications of it, it occupies merely the place of any kind of rubbish; as, when it is used for filling up drains that are afterwards to be covered over, or is laid at the bottom of stacks of corn or hay, to prevent their too close contact with the earth, and keep them from being injured by imbibing its moisture.

To give a particular account of the manner in which heath has been, or may be, applied to all these or other similar purposes, would lead to a long detail, which could not, at this time, excite much interest, or be attended by any proportionate advantage. It will be better, therefore, perhaps, in the remarks which follow, to advert to a

few only of the uses to which this plant has been found subservient—but those of the most important kind, and such as may appear not unworthy of attention, even in periods of the greatest refinement. These uses, of principal consideration, may be classed under three heads:—the first regarding it as an article of food for cattle; the second, as a matter of some consequence in the management of bees; and the third, as a cheap, and by no means despicable auxiliary, in the practice of some of the useful arts:

I. Heath is well known to yield an herbage, which, though not of the most succulent kind, is yet relished in some degree by various orders of our domestic animals. Horses and black cattle will eat the tops of this plant; and it seems to be still more grateful to sheep and goats. In high countries, especially, where these animals are left almost entirely to find their own sustenance, they have a very considerable dependence upon the heath which abounds, in such situations, in every season of the year. During the summer months, it makes a very considerable addition to the natural grasses with which it minglest in their pasture grounds; and, in winter, while these are decaying, or making no progress, it retains its verdure; and offers, at that bleak period, a very agreeable repast to the still unsheltered tenants of the hill. Indeed, but for this last circumstance, it is difficult to conceive, how, with the still too

prevalent economy of those upland districts, the flocks which range in them could be enabled to survive the rigours of that inclement season. There is a striking defect in the greater part of Highland husbandry, that little, sometimes no attention, is paid towards securing a proper supply of winter provision for the sheep or other cattle reared in the mountains. They continue, at this season, to roam the same hills from which they derived their support in the summer; and may be content to pick a scanty subsistence from the remains of the herbage which then plentifully sustained them. Were it not for the prevalence of heath, or some other such plant, in these elevated situations, even this scanty subsistence could not at that time be found; and a neglect in all cases highly prejudicial, must then be completely ruinous. But this plant, continuing to grow during the moist weather of winter, affords a resource at that critical juncture; and, by yielding a sufficiency of food, at least for the preservation of the lives of many valuable animals, guards in some degree against the destructive effects which might otherwise be apprehended. It is the better calculated for this purpose, as, from the strength of stem and height to which it often attains, it is later buried under the snows which fall in winter, and sooner extricated from them than most other surrounding plants. The animals themselves, too, may be able, from the same reason, to expedite the operations of nature w

regard to it, when all their efforts, in other circumstances, would be vain, and to remove the obstacle in the way to this sort of food, long before access could be had to any other. To all which may be added, that this plant, being of a hot, pungent quality, is well fitted to counteract the effects of excessive cold on their constitution ; and on that account must be, and is, particularly grateful to them in that season of the year, when chiefly subjected to it.

Fitted to be thus eminently useful at one period, and under such a defective rural economy as has now been alluded to, this plant does not here lose its value, but may both be of advantage in other circumstances, and even so employed as entirely to prevent that imperfection in husbandry, to which it has already appeared capable of applying a partial remedy.

It has been found from experience, that sheep and other animals may be reared in situations, where, at any time, there is little access to other food for them than what may be derived from heath. And though they do not certainly prefer this herbage to the more genial produce of many of the grasses, yet, whether from love of variety, or some other cause, it is well known that sheep which have been accustomed to it, and are afterwards admitted to richer pastures, continue, when it is in their power, to have frequent recourse to the fields where that coarser viand is to be obtained.

anywhere, need no additional celebrity to afford recommendation to the pasturage ; and, for producing a sound healthful flock, few other plants can be compared with heath, which appears preventive, in some degree, of certain disorders which sheep are liable ; and particularly of the rot, that most destructive pest of this valuable class of animals.

But what farther and most essentially enhances the utility of this plant, is the good account which, as has been just hinted, it may be taken in a dried state. It was an important discovery in rural affairs, which ascertained that the same herbs which afforded, when green, a nourishing food for cattle, might, if cut at a proper period, and duly prepared, continue, in the adequate manner, to serve the same purpose during those seasons of the year when green herbage could be no longer found. The number of plants believed capable of this application, small per-

of heath as a subject from which any very great or general accession to the existing quantity of this kind of food may be obtained. It is neither to be found in every place ; nor, where any other of the vegetables usually cultivated for hay can be profitably raised, should it be suffered to remain. It is only where the situation or the soil admits not of the introduction of a better crop, that its value can be perceived ; but there it certainly may be found of very considerable importance. This will be best illustrated by referring to a country, in which the advantages to be derived from employing heath in the manner now alluded to, have been most fully experienced.

In Sweden, small progress has been made in the art of applying the grasses to the purposes of winter food. The little natural hay that is produced, would go but a short way towards supplying the necessary consumption ; and the cultivated crops raised in aid of it, are neither numerous nor abundant. These circumstances alone would prevent the upland districts from obtaining any considerable assistance, in this respect, from the more fertile provinces, even were that not, as it is, rendered almost impossible, from the very inaccessible nature of those parts, and the badness or the want of roads conducting to them. The peasantry of the mountains, thus left to themselves, and obliged to depend on their own resources, have been led rightly to appreciate an article found adequate to their wants, and to be procur-

ed in abundance, at the expense of only a little labour. Heath has, by them, long been cut and preserved for the maintenance of their cattle during the winter. It is trusted to for this purpose in the same manner as the cultivated crops of other parts; and every thing relating to it conducted with equal regularity and attention. The good effects of this economy are apparent in the prosperity of the hilly districts of that country, and in their being more highly productive than is usually found to be the case in other similar situations.*

As the Highlands of Scotland and other upland parts of the British empire, contain many tracts of territory strongly resembling those in Sweden, where the practice just mentioned has been so beneficially adopted, would it not be a matter of the most obvious propriety, to attend, in such places, to the useful hint thus suggested by another country, and to imitate an example so pregnant with good effects? The great importance of a sufficient supply of winter food for cattle, it would surely be superfluous to evince by arguments. But, in situations which admit not the culture, to any extent, of artificial crops,—where little even of natural hay can be procured,—and where importation from other parts is, by a concurrence of circumstances, rendered difficult or impossible,—how is this to be obtained?

* Berlin Transactions.

The relief to be expected from heath or other such plants, in their green state, is at best but exceedingly precarious. By a heavy fall of snow, all access to this food might be prevented for a much longer time than would be sufficient to prove fatal to animals of the strongest constitution; or, if enough to preserve life might with difficulty be still picked up, how would this serve the purpose of the grazier, to whom it is certainly a matter of the first consequence, that his flocks should be maintained in vigour during the whole of the year, and that the younger part of them should advance, without any interruptions, to maturity in size and strength? Cattle which must annually make up at one season, for the deterioration brought on them from a scarcity of food during another, can never arrive at the same degree of perfection with others reared in more favourable circumstances. If they survive the rigours of the winter, it will be often, from a debilitated and dangerous state, to proceed, in good years, slowly towards a point at which they had formerly arrived; in others, to perish after a little longer continuance of suffering, or to enter on the hardships of a succeeding winter, in a condition still too emaciated to be long able to support them.

But, suppose that as much heath were collected during the summer months, and preserved against this period of difficulty, as would be sufficient, alone, to maintain even for a few weeks,

the animals to be brought through by it, it might be so managed as to preserve them all in health and vigour, during the whole of that inhospitable season. In the early part of it, while considerable remains of herbage could yet be found in the fields, a very little from this store would supply any existing deficiency; and, when the ground was covered deeply with snow, or an almost total deadness had begun to reign over the vegetable world, it would form a fund to which recourse could be had, till, in the progress of the year, the earth should assume a renovated verdure. Thus, by an expedient not less humane than profitable, many valuable flocks might be entirely and constantly preserved from the horrors of want; that mortality among them, so ruinous in bad years, might, in consequence, be often in a great measure prevented; and, in their increased size and price, a considerable accession of wealth might be found for their owners.

That a plant, rising spontaneously, and in situations, often, adverse to almost every other kind of vegetation, should be capable of being applied to purposes so important as these, will not be readily credited by many who, from such circumstances in its nature, (though they, in reality, are what lay the ground of its usefulness), may have been led hastily to pronounce concerning it, as unfit for any good purpose whatever. But, wherefore should prejudices, thus gratuitously adopted, be suffered to prevail over the

dictates of reason and experience? Is not the utility of this plant, in its green state, as an article of food for cattle, obvious from the practice even of our own country? Why then should it be deemed incapable of that other application to which such plants have been so generally found adapted? But there is no need of reasoning on this subject, when facts are so easily to be found. The advantages derived from dried heath, in a country colder and more bleak than the most northerly part of ours, evince its value to be neither imaginary nor inconsiderable. And, though the trial has not often been made, the issue of any such application of it among us has not been to disappoint the natural expectation, that, in another soil producing the plant, and in a climate more favourable to the cutting down and subsequent management of it, equal, if not superior, benefits may be obtained from it.

That heath may be fitted in the best manner for the uses to which, as well in a green as in a dried state, it may thus be appropriated, there will be occasion, though not for any great or considerable expense, yet certainly for some degree of industry. The application of much labour or manure for the improvement of the lands on which this plant grows, far from increasing its quantity, or bringing it to greater perfection, would tend directly to destroy it. It is only in putting or preserving, what of it rises naturally, in a state fit for the maintenance of cattle, that

the art of man can here be employed; but, for this end, it is so necessary, as to be altogether indispensable. When heath has been suffered long, and without interruption, to proceed in its native course, its bushy tops, now grown old and rigid, cease to be relished by any order of animals; and the juices, exhausted in nourishing so enlarged a body of woody matter, are not competent to the sending out of many new shoots of a more grateful softness. The first step, therefore, in endeavouring to turn this plant to any account as an article of food for cattle, must be, so to dispose of that indurated matter, that the roots may be left free to produce and support a new vegetation. With this view, it has been usual, in many parts of Scotland, to set fire to the heath-grounds when become unfit for pasture; by which means, the old stems, no longer affording a channel to the vital sap which formerly circulated in them—that exerts itself in another direction, and gives origin to an abundant tender herbage. The ashes produced by this process not being in such quantity as to prove destructive of the plant, its growth is thereby encouraged; and should the stems, which have been only scorched, be carried away, as they properly ought, for the purposes of fuel, there will be nothing to prevent it from a new extending itself rapidly over the whole surface of the ground.

The proper season for thus burning heath, in order to its improvement, must obviously be that

in which it is least full of juices, and when, from the time of the year, there is little reason to apprehend the approach of any such colds as, in that burnt state, might be apt to destroy it; or, at least, greatly to retard its progress. This season, differing in different places, according to their situation and climate, will be found in all during the spring, that period in which alone this operation has hitherto been practised in this country, and to a part—perhaps too small a part—of which, it has in effect been confined by our law.

That the plants so burnt down may advance again in safety; and to prevent the animals feeding on them from being injured by the ashes, in their excessive eagerness for the shoots, it will be necessary to keep cattle off them for some months—at least till the succeeding autumn--after this deflagration. A supply of food in the interim may be always secured by the precaution of burning the heath grounds in different lots, and by rotation; by which means, some part of them will be constantly kept in a fit state for pasturage, each of those portions, as it decays, being reinvigorated, as before, by the application of fire. The occasion there will be for this process being repeated more or less frequently, will depend both on the nature of the heath, and the purpose for which it is intended. That heath which grows on moss-ground becomes sooner coarse, and is earlier rejected by cattle than the superior quality of it raised in dry, gravelly situations. It will

require, therefore, to be oftener burnt than the other; but with some variation, according as there is to be much or little dependence on it, in its growing state, for the preservation of cattle during the winter. The unfitness of it for that purpose, while so thin and short as it continues for a season or two after burning, renders it proper that longer intervals should intervene, where this is an object in view, than where it is not; but, in every case, the proper time for the operation will be better ascertained by the scragged appearance that will begin to be acquired by the plant, and by its ceasing to be grateful to the animals which were formerly fond of it, than by any other rules which could be laid down on the subject.

The manner of apportioning the several spots of heath-pasture on a farm thus prepared, among the different branches of the stock to be benefited by it, will perhaps be as often determined by convenience as by a regard to any fixed principle. It deserves, however, to be mentioned with approbation, that in some places of this country, where considerable attention is paid to that species of food, it is usual to reserve it, for the first season after burning, for the younger part of the flocks, or the lambs newly separated from their mothers, the older sheep being suffered to range indiscriminately over the fields in which the heath is farther advanced. This regulation serves two good purposes. The more delicate

and tender part of the pasture is, by this means, retained for the animals which stand most in need of that indulgence; and, as these consume less food, and crop not so closely the plants on which they feed as sheep of a greater age, there is less danger that they should eat them down so bare, as, by repressing vegetation, to destroy them. This last is a matter of some consequence, where there appears no probability of the heath, when removed, being succeeded by a better produce; and, in such cases, it is therefore sometimes prosecuted also by other means, the chief of which is, in every stage of the progress of the plant, to keep cattle off it for some time when in a decaying state, or to depasture it by the younger part of the flocks only; especially for a little before, and during the time of its being in flower.

When it is proposed to cut heath that has been burnt in the manner above stated, and to preserve it as provender for winter; instead of its being taken down at the same period at which it would become fit for pasture, it would be better, perhaps, to let it remain till the following year, when it will have attained a length better suited to this application of it. The best time for cutting, as with respect to other plants, will be found that in which the heath is in full bloom *—when its juices

* This period may be admitted the best for cutting down the heath, so far as regards quantity, and we shall not dispute even quality of the hay to be afforded from it; but, as heath is a shrub or woody plant, it is humbly thought that cutting

are in greatest abundance—and it is possessed of nutritive qualities not found in it in equal perfection at any other period. If it be cut in dry weather, as it ought to be, the subsequent management will be very easy; nothing farther being necessary, than to throw it immediately into small cops, in which, having remained a week or two, and being turned over occasionally, it will be ready for being put into large ricks, there to continue till removed to the places where it is to be consumed.

The instrument proper to be employed in cutting down this plant, will not necessarily be in every case the same, but may be varied according to the situation, and other circumstances. Where the ground is pretty even, and the shoots comparatively tender, the work may be tolerably done with a common scythe; but, on rugged grounds, and where the stems are rather thick and tough, it would be better to use an instrument of a some-

It when in bloom, would either kill it immediately, or, if it put out new shoots, that these would not have time to ripen their wood sufficiently to enable them to endure the frosts of the succeeding winter. By cutting the heath in the month of August, and coarse herbage with which it is intermixed in Shetland, for litter, and even fodder for the cattle in winter, the heath has much of it died out in these islands. It would perhaps be safer to cut in the end of June or beginning of July, as soon as the plant had become succulent. But no shrubby plants will suffer being frequently deeply cropped or cut in summer,—the whin perhaps excepted.

what similar construction, but more strongly made, and of a smaller range, suited to the smaller quantity that can, in such cases, be taken in by it at a time.

With an instrument of the description just mentioned, there is no doubt that heath, even of many years' growth, might be taken down : And, after all that has been said with regard to burning it, in the first instance and afterwards, when it has become too old and hard for the use of cattle, it seems not clear, whether the purposes so aimed at might not often be more advantageously served, by cutting it in this manner close to the ground. Any benefit that might be derived from the ashes on the other plan, would, on this, indeed, be lost ; but, in return, all danger from the straying of cattle into the newlyburnt grounds, and taking in part of those ashes with the food picked up there, would be entirely avoided ; the heath so cut down might be applied to any economical use to which, in that state, it should be found adapted ; and the grass growing amongst it, having received no injury from fire, would remain open for use, as it rose up in the spring, thus adding a considerable increase to the value of the pasture.

By such means as have been thus proposed, it should seem that heath may be rendered as serviceable for the use of cattle as its nature will admit ; it being understood, however, that, even in its best state, it will be found not so much adapted to the

maintenance of the larger breeds of animals, or so likely to prove grateful to them, as to make an acceptable and useful addition to the food of those smaller but hardy races of them, which chiefly prevail where this plant is in greatest abundance.

II. Heath is fitted to be of great utility in the management of bees. It is well known that this plant yields a very rich supply of that saccharine matter which bees feed on with so much delight, and which acquires the properties of honey by passing through the vessels of these insects. As the honey thus procured yields not in exquisite flavour to that which is the produce of any other plant, and as it may be obtained from it in such abundance, these circumstances alone should seem to recommend the heath to a greater degree of attention than it seems in general to have yet received. But what is farther and still more highly in favour of this plant, is, that from the period at which it comes to be in flower, it is ready to be applied to the use of the bees at the very time when the great majority of other matters, from which they had formerly derived a subsistence, ceases to be any longer fit for that purpose.

The great importance of having a constant supply of pasture within the reach of these insects, during the whole of the season that is suited to their going abroad, is obvious from our own experience, and may be inferred from the prac-

tice of such as, in other ages and nations, have most successfully applied themselves to this subject. From the writings of different Roman authors who flourished as far back as the time of the Emperors,* it appears to have been then customary to transport bees, with the advance of the season, to the places, at every several period, most adapted to their maintenance. This practice is not yet forgotten in Italy; and, in the neighbouring kingdom of France, it is known to have been acted upon to a very considerable extent; and with great and adequate advantage: M. Maillet, in his account of Egypt, † informs us also of a similar custom still retained in that country, amidst the increasing ignorance of its inhabitants, by which the whole produce of the banks of the Nile is, in succession, brought within the reach of bees sent from the lower parts of it: These conveyed, at the proper season, to the regions where vegetation is in the greatest forwardness, follow, in their return home, the progress of that and of the river, adding, at every new stage, an increase to their treasures; and, in them, to the wealth of the proprietors. Such examples of great and uncommon pains employed with the view of obtaining pasture for bees during a lengthened continuance of time, seem clearly to evince

* Columella, lib. 9. c. 14. Pliny, lib. 21. c. 12.

† Vol. I. p. 24.

the expediency of an object undoubtedly found deserving of being so assiduously pursued. The spirit of this practice should certainly be ever kept in sight by all who, in other parts of the world, would carry to perfection the economy of those useful insects.

In our own country, it is a favourable circumstance towards this end, that the same purposes which, in those cases, have been followed with such an expense of labour and travel, may often be gained here without any trouble at all, and almost always in a much easier manner than, in these instances, it has been thought not too much to adopt. Heath, as was before observed, blooms not till about the beginning of autumn. It remains in flower during the greater part of that season; and is thus capable of being turned to great account for the feeding of bees, at a time when all the earlier productions of the fields have advanced too far towards maturity, to be longer proper for their use. This plant is often to be found in abundance in the higher, and sometimes also in the low grounds, immediately adjoining to other spots from which a sufficiency of vernal and summer pasture for them might be obtained. Here, then, a supply for those valuable insects may be found during the whole of the warm season, without the need of any, or at least but of a very considerable change of place. To remove them at the proper time, merely to the next rising ground will often be all that is necessary, when migr-

tion in any degree is required. But this, though it may appear of little moment, ought not, when there exists the smallest occasion for it, to be neglected, as, by saving trouble to the bees, it will tend to facilitate their labours, and enable them more speedily to accumulate their stores.

When heath is not to be found but at a greater distance, it may be a question with many concerned in the management of bees, whether it would be worth while to take the necessary trouble, in order to avail themselves of the advantages to be derived from it. This point will, no doubt, be best determined by experience; but it is in the mean time worthy of observation, that, as above hinted, access to that plant may generally be had from any part of Scotland, much more quickly, and with a less degree of labour than it has been judged prudent, in other countries, to employ, with the view of securing a continued maintenance to their bees. Of the value of the honey and wax, the productions of those highly industrious creatures, it is unnecessary here to say anything. These are daily employed, for a variety of most useful purposes; and the latter, particularly, is so much in request, that the quantity raised in the country is, in general, by no means adequate to its supply. In such circumstances, it should appear, that any pains judiciously bestowed on the culture of bees would meet with suitable remuneration. For the attainment of which

end, and to prevent the necessity of importing from abroad articles which might be produced in greater abundance at home, nothing certainly can be of more essential consequence than, by a due attention towards providing abundant and constant pasture for the bees, to open the way for the maintenance of them in greater numbers, and for preserving them uniformly in a state in which their labours may be most productive and valuable.

III. The arts, in the practice of which heath may be usefully employed, are chiefly these,—tanning, brewing and dying.

1. In tanning, there are two objects in view—to prevent the leather from rotting, and to render it impervious to water. To gain these ends, without lessening its pliancy and toughness, it is necessary that the astringent substances used for this purpose should contain a considerable quantity of extract; or that, in conducting the operation, they should be joined to other matters possessing that property. The bark chiefly used in the business at present, is fully adequate to it in each of these respects, containing, in particular, a greater proportion of the extractive matter than is found in any other of our native astringents. As, however, the quantity of this article which can be obtained, is but limited, and may sometimes be found insufficient to answer the very great demand, there can be no reason against en-

desavouring to ascertain how far its place may be supplied occasionally by some other substance.

The scarcity of other materials proper for tanning, has given rise, in some of the Western Isles, to the application of heath for that purpose ; * and, as far as the simplicity of the operations carried on by an individual, on account of himself and family, may resemble the larger transactions of an extensive work, there is found a general likeness between the manner of conducting the process with this article, and that commonly in use in other parts of the country.

The first point is to free the skins from their hair, cuticle, &c. which is effected by applying to them a mixture of such lime as can be procured, with water. When these parts have been loosened by this means, they are scraped off as clean as possible, and the skins are thoroughly washed ; as the only semblance of immersion in an alkaline ley, the next usual step in the process. They are then put for some time into a running stream, and apparently with the same view of being thereby rendered thinner and softer, and of having their pores opened for the reception of the ooze. This ooze is procured from the tops of the heath, either alone, or mixed with other astringent moss plants, in one of the following ways. After having been bruised and broken down,

* A similar use of heath is known in France, and perhaps also in other parts of the world.

these materials are boiled in water, till a juice be obtained of such consistency as is judged sufficient, which, having been prepared in necessary quantity, is suffered to cool, and carried to the place where the rest of the operation is to be finished ; or the ooze is obtained by means of the cold water found in or brought to the moss-hole or other convenient situation, in which it is proposed to conduct the process. Into the ooze thus prepared, the skins are then, according to the most usual and best method, immersed, the vessel or pit employed for the purpose being of such dimension, that they may be easily turned in it. Here they continue till the operation be concluded, in a receptacle corresponding chiefly to the *handlers* in the common course of tanning, but which, in reality, is made to stand also, sometimes for the *letch* in which the ooze is prepared, and always for the *vat* where the process is terminated.

From an idea that moss-water contains in itself something of the tanning principle, it is usually chosen, both in a warm and cold state, for the extraction of the ooze, which may be procured from any of the proper plants, whether green or dried, that have not previously lost their virtue, by being exposed to the action of water. When the skins are found to be completely penetrated by the ooze, they are taken out, and hung up in an extended state to dry. The province of the currier, as it is here managed, is speedily

gone through. The thicker skins, or parts of skins, being laid aside for sole-leather, the others are merely rubbed for some time on a board, to increase their flexibility; and, when made into shoes, but not before, have a black colour communicated to them, by the application of some ferruginous matter.

The leather prepared in this manner is found to be strong, durable, and particularly adapted to the use of the rugged districts in which it is manufactured. It seems to last even better than that which is made in the usual way; and tolerably well, though perhaps not so entirely, to exclude water. At the same time, any defect experienced as to this last particular, might, as should appear, be in a considerable degree removed, by mixing with the heath some of the oak bark, already stated to be so well adapted to every purpose of this art.

There seems no reason to believe, that, in tanning with heath, thus mixed or alone, the whole, or nearly the whole, of the same steps usual in conducting the process with the bark by itself, might not advantageously be pursued. The effect of such a change would certainly be, only to improve the quality of the article produced, at the same time that the detail of the operation would become more adapted to an extended practice; but it cannot be expected that any change of this kind should take place, while the business is confined to the same hands with which, in this

country at least, it lies at present. If it should ever come into more general use, the custom of boiling the heath, as formerly mentioned, in preparation of the ooze, though without any counterpart in the present practice of the tanning art, it might be found expedient still to continue. By this means, the whole virtue of the plant may be more completely drawn off, and a proper juice sooner procured than could be the case from the use of cold water. If, however, the expense of fire, and the additional trouble to which this method would give rise, should be thought too strong objections to the practice of it on a large scale, it happens fortunately that the end may be served in that other easier way. The sufficiency of cold water for extracting, in a tolerable manner, the styptic principle of this plant, has been already noticed. And, were the water, according to the recent improvements in tanning, prepared with a small quantity of lime, there seems no reason to doubt that the same ends of expedition and complete exhaustion of the astringent matter, might not, in consequence, be gained here, which have, in other similar cases, been so fully experienced from it.* The question as to the comparative economy of using coal or lime for that purpose, will fall to be tried in the course of prosecuting this new department of the business.

* Dr M'Bride's Account of his Method of Tanning, in
Philos. Transact.

of tanning; and the result may be found different in different situations.

The practice of the districts where this mode of tanning has been chiefly observed, not reaching to those very large thick hides, of which the strongest bin-leather is made, there are not the same means of ascertaining its utility with respect to them, as to those lighter skins about which it is commonly employed. Reasoning from analogy, however, there is every ground to conclude, that if the same means were previously employed for raising and opening the pores of those heavier hides, which are in common use for that purpose, the juice of the heath would be found as effectual in the one case as in the other. Whether the advantages to be gained, in either respect, from any given quantity of that matter, in proportion to the trouble of preparing it, be such as to entitle it to any very considerable or general regard, can be determined only by trial and experience. It is already put beyond a doubt, that, where other and better materials for tanning are wanting, it may be turned to useful account in that art; and, from the degree of astringency which it may be ascertained, by any of the common chemical processes, to possess, †—though not to be placed in

† None of these seems preferable for this purpose, to that of precipitation by the solution of gelatine. Davy, Philos. Transact. 1803.

the first rank in that respect,—it seems to be deserving at least of some degree of attention.

2. Heath may be turned to some account in brewing. The particular suitableness of malt for the purposes of that art, arises from its uniting in itself the two parts, saccharine and farinaceous; —the presence of each of which is necessary for giving to the liquors prepared by this process, that kind of perfection generally required in them. As in the malt, however, the latter of these properties prevails in much more, than, for this end, a due proportion to the other, it is well known that if it were permitted to use other saccharine matters along with it in brewing, different succeeding worts, little inferior to the first, might generally be obtained from the same quantity of malt. With this view, it would be only necessary to guard against the application of such a quantity of artificial sweet to the new menstruum, as might prevent the farther solution of the malt, or be more than a counterbalance to the saccharum, of which it had been previously deprived. The requisite attention towards employing in the process such a degree of heat as, without inducing any bad consequences, would be sufficient to take off, at each time, the right proportion of the farina, is a matter belonging to the general practice of brewing, and which therefore requires not to be here particularly noticed.

From what has been already said of the sac-

charine property of heath, it seems obvious that it might, somehow or other, be usefully employed in this manner as a supplement to malt. Were it, indeed, necessary, with that view, to extract beforehand, and separate this saccharine part from the rest of the plant, the trouble to which this would give rise might be found more than it would be proper to undergo, on account of any benefit to be derived from it. But such does not appear to be the case ; as we know that the entire plant, in its natural state, has frequently been used in brewing, without its being understood that the liquor produced was, in consequence, rendered in any way unpalatable or disagreeable. This practice has, in latter times, been chiefly noticed in the island of Ilay, where it has been customary to prepare ale from materials consisting of one part of malt, joined with two of young heath-tops. The saving that would thus be made in the malt, is certainly a matter deserving of considerable attention,—the more so, as being effected by means of an article, which would otherwise be often lost, or employed to very little purpose. The ale prepared in this manner, we are told, had sometimes the addition of hops given to it, and sometimes not. This would seem to imply, that the addition was not reckoned necessary ; and, if nothing equivalent were used in its stead, might therefore give reason to conclude, that the heath, in this application of it, was found to serve even

the double purpose of first adding strength to a malt liquor, and afterwards of preserving it from acidity.

It may be thought superfluous just to add here, that the same qualities which should render heath useful in brewing, are such as ought also to fit it for distillation. This plant has fallen into such disesteem in our days, that hardly any good end is expected to be served by it. In former times, however, it is known that a strong liquor of agreeable flavour was derived from it, and which was then held in such estimation as to occupy the first place in the seasons of joy and festivity.* There can indeed be no doubt, that a spirituous liquor maybe obtained from this plant, of which, when alone, should the flavour be found not perfectly pleasing, it would be easy to give it that desired, by the junction to it, in the early stages of the process, of something more grateful in this respect, or by compounding it with other spirit.

3. Heath contains a colouring matter, which may be applied to the purpose of dying. This may be extracted as in the case of other astringent vegetables, merely by boiling of the plant in water. Into a strong decoction of this kind, if wool or any other fit substance be plunged, it

* Boethius.

will speedily acquire a fine orange colour,—which may either be retained alone, or form the ground of such other colours as it may be proposed to communicate. But the better to fix this die, it will be always necessary that the matter to be tinged with it should be previously boiled in alum-water, or in a similar solution of some other salt.

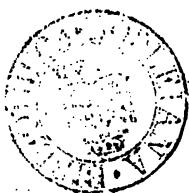
Like the rest of astringent vegetables, heath may also be of use in communicating a black colour to bodies. To this end, let them be first impregnated with any of the usual preparations of iron, and then boiled in a decoction of the heath. The deepness of their tint would be improved by adding to this bath a small quantity of some fixed alkaline salt; † as, to produce the finest colours of this kind, it is common that the matters to be so treated should first of all be died blue with indigo.

Such are a few of the economical and useful purposes to which heath may be applied. It is indeed a highly gratifying object to behold the grounds which were once covered with this plant gradually assuming the appearance of luxuriant corn-fields, and waving with all the riches of a plentiful harvest. But where it is evident, that instead of any effect of this kind being produced, the extirpation of the heath could be succeeded only by total barrenness, and a desolate

† *Percival's Essays*, III. p. 335.

waste, better surely it were that the original produce should be suffered to remain; better far, if that can be in any way so employed as to yield any, even the smallest advantage, to individuals or to society.

1805.



ESSAY

ON

CHARRING PEAT.

By Mr GEORGE SAUNDERSON,
Land-steward to Mr Brodie of The Burn.

THE first charred peat that ever came under my observation, was in Holland, in the year 1792. There I saw it used in various ways, and by every class of people, from the prince to the beggar who walked the street with a small pot of charred peat, to keep him warm in the winter season. Peats being the common fuel in Holland at that time, I observed that they were used in every kitchen; where, in the first place, they were burned in the same way as coals in a range for roasting, boiling, &c.; and, in the next place, when charred peat was wanted for the kitchen-stoves, chafing-dishes, or any other purpose in the

family, an ample supply was to be got at all times from the kitchen range. This is the method which the Dutch take to char peat for family use as well as for churches and all public meetings in cold weather.

Since my return from Holland, which is nearly nineteen years, I have made various experiments on charring of peats; but more particularly since I have had a house of my own, situated in the vicinity of an extensive flow peat-moss. After making different trials, I find that it is only the black, hard peat that will char: the soft brown peat, which is full of roots and small pieces of wood, will not char, but burns down to ash in a short time. The best peats that I ever saw with in this country for charring, was at Elgin in 1795: they were hill peat, and came from the parish of Birnie.

The statement that I propose to give you, what appears to me the best and cheapest method for charring peat, is included under two general heads: *First*, The charring of peat in the kitchen grate, where it answers for fuel in the first place and will be a saving of coals: *Secondly*, The charring of peat at the moss where they are dug.

1st, Charring of peat for family use, and where charcoal is required for cookery, &c.—I would recommend, that every gentleman situated within a few miles of a peat-moss, should lay in eight or ten cart-loads of the best black, hard peat, for

the purpose of charring, every season: they should be drove when they are perfectly dry; and kept under cover from wet. When charcoal is required for cookery, or any other purpose in the family, take a dozen or fifteen peats, and put them upon the top of the kitchen fire, upon edge; they will soon draw up the coal fire, and become red in a short time. After being turned about once or twice, and have done smoking, they are charred, and may be removed to the stoves: if more char is wanted, put on another cargo of peats as before mentioned. By following this plan, you keep up the kitchen fire, and have at the same time, with very little trouble, a supply of the best charred peat, perfectly free of smoke; and the vapour is by no means so noxious as charcoal made from wood. Peats charred in this way may be used in a chafer, in any room, or even in a nursery, without any danger arising from the vapour. It would also be found very fit for the warming of beds, and much better than live coals; which is in general used full of sulphur, and smells all over the house. The author has used charred peat in a small closet which had no fire place, for the purpose of dressing and undressing a young child, in the summer season of 1809, with perfect safety.

From the experiments that I have made, I find that peats charred in a grate, and applied to the purpose of charcoal immediately, without be-

ing extinguished, makes the purest and best char, and freest of smoke. When peats are charred in a large quantity, and extinguished, any part of the peat that is not thoroughly burnt in the heart will imbibe moisture; and, when used, will smoke, and have a disagreeable smell, which would at once hinder charred peat from being used in a gentleman's family.

To my certain knowledge, it is a very common thing for noblemen and gentlemen, who reside in Scotland part of the year, to order, along with other stores, charcoal from London for the use of their kitchen. This may be considered like driving coals to Newcastle; since a supply of peats may be got upon their own property, that will answer every purpose of charcoal if properly made, and would be a great saving of pit-coal.

2d, Carbonizing peats at the moss where they are dug, I have had less experience of: But, from the few trials that I have made, I find it is practicable; and I am perfectly convinced that it is the cheapest method by which peats can be charred upon a large scale, for forges, or drying of malt, &c.—as it saves the carriage of the raw material. A single-horse cart load of peats, when charred, will only fill two common sized wheel-barrows. But much depends upon the quality of the peats:—if they are not of the very best kind, and properly dried, you may not have above one= barrowful of char.

The best method that I have found for charring peats where they are dug, is—when the peats are properly dried, wheel to the outside of the moss a single-horse cart load of them. Level a spot of ground, about seven feet in diameter, near to a drain, and drive a stake of wood into the ground about five feet long;—roll some dry heather, or pob, (the refuse of flax), round the stake, and lay some also upon the ground where the peats are to be placed;—then set the peats upon end all round the stake, inclining to the centre, with a little dry heather or pob between each floor of peat, until near the top, or last course:—then they are laid in a horizontal direction; and the stack, when finished, is in the form of a bee-hive. The next operation is to set the stack on fire, which is done at the bottom all round: the fire will soon run up the post in the centre; and when the heather or pob is all consumed, the space forms a chimney, and occasions the stack to burn regularly. If the windward side should burn too fast, apply some wet turf. When the peats are thought to be sufficiently burnt, which is easily known from the appearance of the smoke, apply wet turf* and water from the adjoining drain as fast as possible, until the whole be extinguished;—the charcoal may be removed upon the following day.

* Whatever excludes air will answer this purpose.

The last experiment which I made was upon the 17th September last. I took two men with me to the moss at two o'clock in the afternoon. They wheeled out a cart load of peats; set them in the way I formerly mentioned; burnt them, with my assistance; and brought home the charcoal, at the distance of a mile and a half, a little after six o'clock. The whole operation was performed at the moss in about three hours and a half. The men employed had never seen any work of the kind before; but indeed the oldest man that I have met with in this district seems to know nothing about the charring of peats.

This last experiment has been made for the sole and only purpose of sending a specimen of the charred peat to the Highland Society at Edinburgh, which is sent accordingly, along with this short Essay.

4th October, 1811.

ESSAY

ON

WHIN HEDGES.

By Mr Gordon of Swinzie. 1804.

It is allowed, that agricultural improvements, carried on in barren and remote countries, and in high, mountainous, and exposed situations, distant from markets, must meet with many obstacles and inconveniences not known to happier climates, where ready markets, and a fruitful soil render the occupation of husbandry both more easy and agreeable. In the former, there is always a great quantity of waste and uncultivated ground, and a small quantity of arable. From this arises the difficulty of improving the waste and uncultivated part; for the arable will require for itself all the dung that its produce will make, and leave little or none for the other.

The produce of an arable field in such a country, falls greatly short of one in low and fertile situations, near market towns. Its scanty produce prevents the farmer from keeping a stock of horses and oxen sufficient for the many ploughings the waste grounds require ; for the clearing them of stones ; the carrying to them lime, marl, or earth, or such manures as he may find, or be able to purchase in the neighbourhood. He cannot buy straw or hay, or straw and corn together, from his neighbours, for they are all in the same situation with himself ; and indeed the buying straw, or straw with the corn on it, is in a manner unknown in the remote and highland parts of Scotland. From this will appear the advantage of any fence that will answer the double purpose of an enclosure and food for horses and cattle. And, in proposing such a fence, I will not advance any thing regarding it but what I have known from my own experience ; as I have seen, and daily see it answer the double purpose of an enclosure, and serve at the same time for food to horses and cattle, and that in a highland exposed situation, as well as a maritime and poor soil ; no part of the fences I mean to offer to the consideration of the Highland Society being above half a mile from the sea, and situated in the county of Caithness. I have a farm there of the extent of about one hundred and fifty Scots acres, in a good measure enclosed (with whin hedges, that grow to a considerable height) about 12

years ago, previous to which it was mostly waste ground; and such of these hedges as have come to their growth are so close and strong, that not the lightest and wildest highland cattle can get through them, after they have got up but a very few years, on banks thrown from ditches, for the purpose of sowing whin seeds in them. And it is well known, that no species of live-stock are more destructive to hedges in general, or get sooner through, or over other fences, than what is commonly called black cattle, from their stinted growth, and the starved way in which they are often reared, as well as from the manner in which they are allowed, when young, to range about among hills and mountains. Some people make it an objection against whin hedges, that they spread and injure the fields they enclose, and that their roots are very difficult to be ploughed up, or otherwise destroyed. In lands that lie on beds of gravel or sand, and such as are naturally dry, whins are apt to spread; and if such lands are level, and a considerable part of them in tilth,* or in valuable pasture, whin hedges in such grounds might endanger the fields they enclose, by spreading so as to be very troublesome and difficult to be rooted out: it is therefore obvious, that in such lands they ought not to be made use of. But on grounds that lie on beds of

* It is only when lands are laid to pasture for several years, that whins become troublesome. Whins can never grow among grain crops under fair cultivation.

clay, rock, flag, or till, whins may safely be reared into hedges; for these substances not allowing rain or moisture to get far down during the winter and spring, the ground becomes so wet and miry, that the whin seed perishes in it during these seasons, when not sown in banks to exclude the wet. And where ground has this quality to a great degree, wood will not grow in it, as the young shoots from the root perish in the same manner, and from the same causes; a circumstance constantly experienced in this county of Caithness, where some of the inhabitants have in vain * endeavoured to get wood to grow. But although the whin seed perishes in this manner on level ground of this quality, owing to the wet nature of it, yet if it be raised and thrown up into a bank, and by this means exposed to the influence of the air and sun, it will grow there. It may be said that the mountainous and exposed Highland tracts of Scotland are, generally, if not all, of this last description.† In them there are quantities of ground that cannot be made arable, so as to produce corn or grass sufficient to reimburse the expense and labour that it would be necessary to lay out on them; and from their be-

* It is humbly thought the peninsular situation of great part of the county of Caithness may be, in so high a latitude, inimical to the growth of most sorts of trees.

† The surface soil of by far the greatest part of the Highlands of Scotland is peat; and on this, it is thought, whin ~~will not grow.~~

ing too near the sea, or from other causes, such as too elevated a situation, wood will not grow on them: But on such grounds whinst thrive, and afford both food and shelter during the inclemency of the winter and spring, if this last can be said to take place in the high and exposed parts of Scotland, particularly in the most northern parts of it. On such tracts of ground, I will venture to affirm, that no inconvenience will arise from rearing the whin plant for hedges, but that the most beneficial consequences will spring from it. It is now twelve years since I sowed the first of my whin hedges, on a declivity as dry and equable in its surface as most situations in the Highlands; and I have never known the smallest branch spread in any of the fields from the surrounding hedges, as the soil is on a bed of clay and till. I have even found that they will not grow in any bank of earth, but when it is newly thrown up; for, if it remain more than a year unsown, it will become too dry for the whin seed to vegetate in it. This I have found, from repeated efforts to make them grow in such banks; though I cannot account for their not growing there, when they grow so much, and are apt to spread in lands that are naturally dry; unless the level surface of these last, by imbibing more of the dew and rain as these fall and sink through them, be the

† In high and very exposed situations, whins, if they grow at all, never come to the height of a fence, and are killed by severe frost to the ground, every hard winter.

cause of it. And if they did spread, they would soon be destroyed by cattle if the field were in pasture, or by the scythe * if in grass for hay unless the nature of the ground is so dry, from the causes before mentioned, as to give too much encouragement to their growth. In tracts of barren and exposed waste ground, thorns of any kind will not grow to perfection, at least not so vigorously as to become a sufficient fence against small, hungry, light, Highland cattle ; and if they did, they would not serve for food like the whin fence. This led me to try it as an experiment in the following manner. I made a ditch six feet wide at the top, and one at the bottom, and four feet deep ; the earth thrown out to one side formed a bank, and on the other side of this bank was made a smaller ditch, three feet wide at the top no wider at the bottom than to allow a spade to turn in it, and two feet deep ; and the earth of it thrown likewise up on the bank in the middle between the two ditches, which, by this means became of a considerable height and breadth. The base of this bank might be about nine feet wide, and it tapered up to the top, so as not to be there above the breadth of one foot, or fifteen inches ; and on this were placed such stones as were taken out of the ditches, and the field thus enclosed, so as the more effectually to prevent

* It is humbly thought, that neither the scythe nor cattle will destroy whins. The former may, if applied in a proper season, weaken them much ; but cattle of no kind ever will.

cattle or horses from getting over it. There was then a small drill made with a spade on each side of the bank, about a foot or fourteen inches from the ground, that is, from the solid ground on which the earth in the bank was first thrown.— I have since found, from experience, that, if the drill was higher and farther up the bank, the fence was not so strong, or nearly so close. This drill was not deeper than any of those into which garden seeds are commonly sown; and the whin seed was sown and put into it in the same manner that seeds are sown in a garden, and then the drill was closed up on the seed by a stroke given to it by the back of a spade. This is all that it requires. Two drills put in each side will answer still better than one, at about the distance of a foot, or a foot and a half from each other. The whin seed was, at other times, sowed in broadcast upon each side of the bank; this having been first punctured by the points of a garden rake, and then beat or struck, and smoothed over, by the back of the spade, so as to cover the seed:—and this method answered equally well with the other. Care should be taken that the seed be not sown too thin, and that no intervals whatever be left without seed; for, when this happens, breaches are apt to occur in the fence, where the whins do not get up, either from want of seed, or from its being shaken out by striking too hard or carelessly with the spade, or from its perishing. And, wherever the plants do not grow, cattle will

always attack that part, unless care be taken to have it otherwise well fenced. The best time for making these ditches is from the beginning of October to the beginning of May; and the best time for sowing the seed is from the middle of February to the middle of April; and it should be always sown as soon as possible after the ditches are made, and the earth thrown up — for, after the bank dries by means of the summer drought, the whin seed will not vegetate in it, unless a spadeful of the too much dried earth be taken out all along the side of the bank in the line where the drill is to be made, and a spadeful of fresh earth put in the room of it; and then the drill made, and the seed sown as before. Nor will it answer so well then, as when the earth in the bank is newly thrown up. In order that the seed may be sown the more evenly, and securely, the sides should be made smooth and even with the point of a spade, if the earth has been roughly cast up; and the drill may be made, by means of a line supported on the sides of the bank by small wooden pins. At first, I mixed some broom seed along with the whin seed, but it did not come up well; and as it might be the means of weakening the hedge, as cattle are not afraid of it, and that it spreads more, and is worse to root out than whins, and is not for cattle or horses such good food, if any at all, it is better not to sow any of it with the whin seed. It is said that broom is a medicine for sheep, and pre-

vents the rot. If it be so, some broom may be sown for that purpose ; but it is natural to suppose, that what may be proper as a medicine, may not be so for food ; and the broom wanting the sharp points of the whin will not answer for a fence, nor will it grow so close. The soil most adapted for these hedges, and where the whins grow best, is poor, gravelly, sandy, or light clay soil ; but in rich clay, or loam, they will not grow, particularly in the latter.

If these ditches are made in arable ground, or through small parts of arable land, the loam on the surface where they are to be made may be carried off for dunghills, or carted away to the barren and waste parts of a farm ; for, if any part of it composes the bank where the whins are to be sown, the weeds and grass that spring up from it choke and injure the young sprouts of the whins for the first and second year after they appear ; and care should be taken not to allow any weeds to grow up among them for these two first years, or sheep or cattle to injure them ; but after the second year, they grow so vigorously as not to be much affected by injuries of that nature ; and, if this care be taken, they will grow very fast and close from that period. The bank, therefore, should be perfectly free from rich earth, or loam, weeds, or the roots of grass. In case part of an enclosure only is made, such as one side, or two sides of it, and the bank be sown with the whin seed, care should be taken to secure

and fence the ends of it; for it is there that cattle get up on it, when they cannot get up on the sides; and they are apt to walk on, and trample down the very place where the seed is sown, unless this precaution be taken. Some people, when they make a ditch, place a layer or two of the turf taken off the surface on the inner edge of the ditch, so as to support the earth thrown out. This should not be done if whins are to be sown, as the grass that grows up from this layer of turf or sod, * chokes and prevents the growth of the young whin plants.

One of the greatest advantages that this fence has over thorns or other plants, is the length of time that it lasts, without any assistance or repair whatever; for I have found by experience (from which alone I speak), that as soon as the top branches and other parts of these whin hedges grow bare, a new set of young shoots spring up from the lower branches, so as to support the upper ones; and the more the hedge is cut and pruned, the closer and stronger it will grow, and the longer it will last; while, before the upper branches are bare and decayed, the lower ones are so much up, as to prevent cattle from attempting to get over the fence. I have reason to believe they will grow for a great many years in this manner; for I have some of them of twelve years standing that so grew; and this

* If the turf were inverted, it would not do so.

fence never, during that time, gave me the smallest trouble ; and no beast ever got, or attempted to get over it, where it grew close and thick, which it always does, when it is properly sown in ground adapted for it, and in a bank. It will grow in any soil, black rich loam excepted ; and it has now the appearance of being a durable and sufficient fence for a great many years to come. Another advantage it possesses is, that it answers for food to horses, cattle and sheep, during the winter season, in countries such as the Highlands, and other waste, barren, and bare parts of Scotland, where provender is always very scarce, and where a number of cattle and horses die every year from the want of it ; the inhabitants being often obliged to give them a great part of their corn to keep them from starving to death.

The annual shoots of the whin (for no more should be taken or cut off) will serve as food for horses, by being bruised in any manner by a mill or other machine, or thrashed with a flail ; and so fond are they of them, that they prefer them to hay ; and I may venture to say, that a peck of them well bruised is equal to a feed of oats, and in the same proportion of nutriment as to hay ; but I cannot, and will not say, that I ever made any exact experiment as to this. I have often seen horses run to a whin-hedge, and eat the young shoots, of course without being bruised. Some say that it is dangerous to give whins to cows or oxen, without being extremely well

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ised, as these animals are apt to be choked them, when they bring them up in the act of chewing the cud, and that they should not even be given to them at all. I have sometimes given them to such cattle; and I have seen them eat the young shoots of the hedges, in the same manner as horses do, and never knew or heard that they were the worse of it. They indeed only eat the very tops, the softest and tenderest parts, which the person that cuts will always attend to, but will often cut more towards the root, which cannot be so tender. A great advantage the whins have over other plants, is that they need not be sown in a nursery, after the trouble of rearing them there, but where they are to grow as a hedge. Towards this trouble and expense; and it is a remarkable fact, that they never should be transplanted, always sure to degenerate in consequence of the process.

Another advantage a whin fence has, is that it is an evergreen, and looks best in almost every other tree and shrub, country (the fir excepted), have lost their leaves by the time the whin shrub blooms in the month of June; and its bright yellow colour smell during that season, are both pleasant. Whins grow vigorously,

the sea ; except in situations where there is so much spray, and its saline particles are so strong, as nearly to destroy all vegetation ; for there, neither corn, nor even grass, will grow, except in a poor, short, stinted state, that scarcely deserves the name of herbage. The whin plant will grow in any soil, if it be thrown up into a bank, such as has been already described, loam and rich earth excepted. * For these considerations, there is no plant so proper for enclosing countries where there are extensive commons, or great tracts of waste ground, whose situations are high, or much exposed to cold and bleak winds.

* It is humbly thought whins will not grow in a peaty soil. Nor will they grow in very high situations, in any soil whatever.

AN ACCOUNT

OF THE

**PRINCIPLES OF CONSTRUCTING AND
REPAIRING ROADS.**

By MR PETER CHRISTIAN of Stonehaven. October 1815.

Palmam qui meruit ferat.

THE construction of roads consists of two main operations—*forming* and *metalling*; terms so generally understood, that it may be deemed unnecessary to define them, even so far as to observe, that the first comprehends the work requisite for preparing the site of the intended road for receiving whatever covering may be designed for enabling it to resist the weight and impression of horses and carriages; and that the second embraces the preparation and application of such covering.

An account of the operation of forming a road,

includes the consideration of a variety of circumstances, upon which much of its future utility depends. It were impossible to apply these circumstances to individual cases, so as to compose a separate system for every particular situation. Such general principles may, however, be laid down, as will furnish *data* for most cases that are likely to occur.

The great objects to be attained in forming roads, is to render the ground which they are to occupy dry and compact; and to bring it to a smooth and level, or regularly sloping, surface.

Having these objects in view, the first duty of the roadmaker is to mark off, or trace on the ground, the line or direction of the road, by sections, as laid down on the plan of the road-surveyor. In doing so, the former will take care, where it deviates from a straight line, to conduct it by easy sweeps, so as to avoid the stiff appearance and practical inconvenience of sharp corners and abrupt turnings. If the formation be begun by different workmen, on different sections, at one time, it will be particularly necessary to attend to these circumstances, otherwise inconvenient and offensive angles may be made in connecting the different parts. Having ascertained the total rising or elevation on each section, he will proceed to distribute it as equally as possible along the section, by cutting and embanking; that is, removing the earth which rises above the

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intended level or slope-line, and making up the hollows which sink below it. If the materials to be removed from the heights shall be insufficient, either in kind or quantity, for filling up the hollows, the deficiency should be taken, not close by the side of the road, but from places at such a distance as will prevent injury to it, or danger to passengers. If, by carrying the road along the acclivity of a hill, side-cutting and embanking be required, it may, in general, answer to remove from the upper, and lay upon the lower side, just as much of the soil as will afford a level surface equal to the intended breadth of the road; but, often, a great deal more may be necessary, as the bank, both above and below the road, must, in all cases, be brought to such an angle or slope as will prevent its slipping or falling down. Where the bank is composed of soft earth, an angle of 45 degrees will be required; but, where the cutting is through rock, a greater degree of steepness in the adjoining banks may be allowed. If the road is to be carried through wet or boggy ground, a quantity of embankment must be executed, sufficient to give it proper consistency, and to form a hard and dry bed for the metal. In such situations, brushwood, broom, *whins*, or long *heather*, if at hand, may, in addition to embanking, be most advantageously used, as a bed for the metal, or even over the whole breadth of the road. In selecting materials for embankment, care should be taken that they be

of such quality as to compose a firm and compact body. This is a proper object of attention in all situations; but especially where the materials are to be used for filling up the spaces at the flanks of arches, or between retaining walls. In these cases, nothing but stones or gravel can be used with safety; an embankment of clay or earth being apt to swell in the wet season, so as to force out the building by which it is confined. It may happen, however, that neither embankment, nor the application of brushwood, may be sufficient to render the bed of the road fully dry. Drains dug across the road, and filled with stones to the surface, must therefore be resorted to. These must, of course, be so formed and situated, as most effectually to intercept the water with which the road is infested. Lateral ditches, deep enough for receiving the water from these cross-drains, will also be wanted; and if the road is apt to be inundated from the adjoining ground, ditches for cutting off the access of such water will be required: And, in every case where a road passes along rising ground, it will be of advantage to have a ditch for intercepting the water descending from that ground. All these lateral ditches ought to be of a depth and width sufficient to receive the greatest quantity of water that possibly may run into them at any time, and should, for security, be situated several feet from the side of the road, so that a fence may be erected, if required, between them and the road itself. It is

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of the utmost consequence to render and keep the road dry. Water should therefore never be allowed to run far on the upper side of it, but should be carried across the road, and led off, even from the lower side, as soon as possible. Water must be conducted across the road, either in arched, or in square eyes or sewers. These will also be used when the road has to cross the course of small rills, or to pass ravines or hollow places, through which water occasionally runs in small quantity. Where it is necessary to place a considerable embankment on the top of eyes or sewers, or to make them wider than 30 inches, it will be advisable to have them arched, and of regular masonry. In other circumstances, square eyes or conduits, executed by the roadmaker, may answer the purpose. These conduits are formed of two collateral walls, built of sizeable stones, with or without mortar, and covered with strong stones, in length not less than double the width of the conduit. In the case both of arched and square eyes, they should be sunk deep enough to allow a covering of gravel to be laid upon them sufficient to resist the concussion of carriages ; and the ends of them should be protected by stones, three or four feet long, sunk endways in, and rising one foot above the road ; and all sewers, conduits or eyes, should be larger than is just necessary for receiving the current of water, otherwise they may be obstructed by ice in winter. The construction of bridges for pass-

ing rivers or considerable streams, is the business of the architect. The care necessary in forming embankments on them, has been already adverted to; and it may not be foreign to the present purpose, to recommend, that the execution of such embankments should, if practicable, be entrusted to the mason, so that he may not lay any eventual insufficiency in the building to the account of the roadmaker. When water from the mouths of sewers or otherwise, must necessarily be conducted down a bank, by cutting which it would undermine the road, it will prevent that injury, if a gutter be formed of good turf, the pieces of which overlapping each other, so that the water may easily run over them.

The site of the road having been brought to a level or regular acclivity, and rendered perfectly dry by all necessary cross-drains, conduits, and lateral ditches, the roadmaker will bring the surface into a * convex shape, so that the inclination from the middle to each side may be about the rate of an inch on three feet. This degree of inclination is necessary for allowing the sur-

* Convexity of surface in a road is more specious in theory than useful in practice; for, carts make ruts deeper or shallower according to circumstances; and these ruts, being longitudinal, or parallel to the line of the road, must catch great part of the water that falls on the surface of the road, and prevent it from reaching the little gutters at its sides, as much as if the road had been nearly flat.

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face-water to run freely off the road; and a greater slope would be inconvenient and injurious. Another principle is, to make the surface of the ground flat, and to give the road convexity, by laying the metal, or covering, deeper in the middle than at the sides. But as it is desirable, at least, that all the metalled part of the road be subject to an equal degree of use and pressure, so, it is proper that it be made capable of the same resistance in one place as in another; which will not be the case, if the stratum of metal be of less depth at the sides than in the middle. The surface being moulded into one or other of these shapes, as may be preferred, the sides of the road must be terminated by gutters dug merely of sufficient width and depth to receive the surface-water. From these gutters it must be conducted, as soon as practicable, into the lateral ditches before mentioned.

The operation of forming the road will now be completed; and it will be of much advantage, if some months can be allowed to elapse before the operation of metalling be begun, as the embankments should have time to subside and acquire consistence; so that inequalities, from the sinking or settling, may be corrected before the metal be laid on. †

† It may be most eligible to form before winter, after vest, and to metal in the spring or summer immediately lowing.

The road being formed, a space in the middle, proportioned in breadth to the width of the road, must receive a covering of such materials as will enable it to bear the weight of heavy carriages ; which covering, in the language of road-making, is termed *metal*.

The width of public roads will vary, according to circumstances, from 20 to 40 feet ; and the space to be metalled will, in like manner, vary between 10 $\frac{1}{2}$ and 20 feet; although, in the neighbourhood of large towns, where intercourse is great, it may be necessary to extend the metal to a greater proportion, or even over the whole road.

The choice of materials, for metalling a road, must be guided by local circumstances. If the soil, over which it passes, be strong and retentive, or if the intercourse be very great, stones broken with hammers are fittest for the purpose, and most commonly used. If the soil be of a nature pervious to water, good gravel may be resorted to ; and it is often used, even on retentive bottoms, where stones cannot be procured but at too great an expense. When the nature of the soil, and the state of the intercourse, sanction the

† If the metalled part be less than fourteen feet wide, two carts cannot safely pass each other on the metalled surface.

use of gravel, it will be found to make a more * durable and much pleasanter road than one covered with stones. In some parts, where neither stones nor gravel can be had in sufficient quantity for metalling roads, it is the practice to pave them ; but, as there are few situations in Scotland where recourse must be had to that expensive, and, to the traveller, most unpleasant construction of roads, it is not thought necessary here to take farther notice of it. †

The choice of the metal being decided according to the circumstances which have been adverted to, the manner of preparing and laying it on comes now to be explained. Where stones are used, it is sometimes the practice, originating probably from a principle of economy, to have the lower half of the stratum broken to one size, and the upper half to a size smaller than the other. In very wet situations, that practice may be proper; although, even there, its efficacy may reasonably be doubted ; as experience rather shows an unexceptionable advantage in having the stones

* The superiority of roads constructed of gravel, over those of hard stone, can hardly be admitted in any respect, but never as to durability ; for, as gravel is almost always composed of fragments of different degrees of hardness, these must sooner waste than stones of uniform firmness and solidity will.

† In some districts of the island, where there is neither stone nor gravel to be had, burnt clay is used as materials for roads,—as in some parts of the West Riding of Yorkshire.

broken as nearly as possible of the same size. When the stratum is composed of stones of unequal dimensions, it is uniformly observable, that the action of horses and carriages forces the small stones under the larger ones, which are thus raised to the top. The surface of the road is, of necessity, rendered uneven and irregular ; the concussion of heavy carriages, descending abruptly from the tops of large stones, soon forms holes in which water is collected : The foundation, or bed, of the road is thus soaked ; the metal consequently sinks into the soil ; and hence one of the principal causes of disrepair. It is sufficient, to give a preference to the practice of forming the metal stratum of stones, all of the same dimensions, that the effects now mentioned will thereby be prevented.

The size which experience has sanctioned in the breaking of stones, is that of a common hen's egg.* Where, however, the lower half is allowed to be of different dimensions, the rule is the size of a man's fist, for that half. Where the metal is laid on a flat bed, it should be of the depth of 12 inches in the middle, and fall off gradually to the sides, where it should be reduced to nine inches. This, if 18 feet be metalled, gives the requisite convexity to the road. But, it has been

* This, it is apprehended, will be found too large a size. By breaking the materials much smaller, they will pack much better, and less repair will be found necessary.

already recommended, to give it convexity in the forming, and not in the metalling; and in that case, the metal should be laid on equally of the depth of 11 inches from side to side. If the lower half of the stratum is to be of larger stones, they should be carefully placed with the hand, so as to form a close and even surface for the reception of the upper half.

With regard to the kind of stones proper for metal, it is sufficient merely to observe, that those should be selected which are best calculated to resist the weight and friction of carriages,—as whinstone or granite.

If gravel is to be used, instead of stones, it must be laid on to the depth of 15 inches; and that which is hardest and free from earth and clay must be selected. If gravel cannot be procured clean from the pit, it must be harped, or taken up with harp-shovels; and the stones, of a size larger than a hen's egg, should be broken and laid in the bottom of the stratum.

The depth of metal now recommended is calculated for roads subject to an ordinary degree of intercourse. Where that is very great, as in the neighbourhood of large towns, or where the soil is very deep and wet, it may be proper to increase the depth of broken stones to 15 inches; and in such situations, metalling with gravel should, if possible, be altogether avoided as unsuitable. On the other hand, where the intercourse is unfrequent, a less depth of metal than

What was first mentioned, may be admitted ; although it will not, in the long-run, be economical, in any situation, to have less than nine inches of broken stones, or twelve inches of gravel, on a public road.

Before laying on the metal, whether of broken stones or gravel, it is sometimes the practice to cut out a trench for its reception ; but this practice is evidently improper, not only as being expensive, but because a trench in hard retentive ground must retain the water, the consequences of which must be obvious. It is a better practice, therefore, to lay the metal upon the surface, and make up the sides of the road to correspond with it, so as to form a regular slope from the middle to the side gutters. The degree of slope may, if necessary, be increased from the side of the metal to the gutters, for more effectually letting off the water from the road. But where cutting and embanking are necessary for lessening the acclivity of any particular section of the road, it may be allowable to sink a trench for the metal, on the height, and lay it on the surface at the bottom of the rise ; because that will make a difference, in the work of cutting and embanking, equal in depth to twice the depth of the metal ; and, besides, the risk of injury from water in the metal bed, on a sloping part of the road, is not so great.

The sides of the road being made up to correspond with the metal, the latter must be cover-

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ed, or, as the term is, *blinded*, * with a coat of clean hard gravel, properly harped and prepared for the purpose. The whole surface should then be dressed perfectly smooth and regular; all loose stones should be picked off, and the side gutters and ends of drains and conduits cleared out, for the free passage of the water.

The road, as thus finished, should if possible be left to consolidate for some months, and should not be opened to the public till Midsummer; as its durability will greatly depend on its being first used in dry weather.

Particular and constant attention should be paid to it during the first year, as in that period it will be most susceptible of injury; and the prompt repair of failures which may then occur, will save much expense in future.

The settlement, or falling, of embankments; the sinking of the metal; the formation of ruts and holes; the obstruction, or undermining, of drains and conduits; and the stagnation, or current, of water, on the surface or sides of the road;—are the principal evils to be guarded against. Indeed, the prevention and removal of these, con-

* There seems a degree of inconsistency in recommending the use of gravel with small stones, as it will be more apt to sink among these, than small stones are among larger ones. If good hard stones, of uniform quality and size, considerably smaller than a pullet's egg, be used, no gravel will be required.

stitute the means of keeping a road in repair. If a general and equal settlement of the metal has taken place, and the sides have become higher than the middle, so that water lodges on the surface of the road, instead of passing to the side gutters, this may in some cases be remedied by paring the sides, so as to restore the necessary slope from the middle of the road. Should that be insufficient, an additional quantity of stones, or gravel, must be laid on, in order to produce the requisite convexity. If ruts have been formed, by a part of the metal being shifted to one side by carriage wheels, it should be immediately replaced, and the surface made even and regular. It may happen, however, that ruts are formed by the weight of carriages pressing down the metal into the soft soil in the bottom. In that case, new metal will be required to fill up the ruts, into which it should be forced as firmly as possible, and made to unite exactly with the adjacent parts of the old metal. If the metal has sunk in particular places, or holes been formed, in which pools of water stand, it is best to take up the metal to that extent, and to relay it with whatever addition may be necessary for equalizing the surface; taking care that the old and new parts be exactly incorporated. Indeed, this should be a rule, in all cases, of laying on additional metal. But, instead of it, it is a prevalent enough practice, just to lay loose stones upon the surface, leaving them to be forced into the road by the

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pressure of carriages ; the consequence of which is, that although one hole be filled up, another is formed on each side of it, by an operation formerly noticed. The embankments, drains, gutters, conduits, and other water-courses connected with the road, should be frequently examined, and particularly in the time of floods ; so that any failure of these works, or obstruction of the water, may be remedied. Indeed, attention to these matters, and the repair of ruts and holes immediately as they occur, should form the sole occupation of a person employed for the purpose. If it should appear that the road is suffering from the want of proper off-lets for the water, what is necessary should be immediately supplied. Mud, collecting on the surface of the metal, should be regularly raked off; a covering of two inches of clean harped * gravel should be added every year ; and all loose and protuberant stones which, from causing irregularities and unevennesses, are likely to occasion injury to the road, should be removed, broken, and incorporated again with the road, as they appear. If, besides these reme-

* If gravel be thought unnecessary in the first instance, it is surely much more so in this state of a road. It cannot incorporate with the metals of the body of the road, which, if properly constructed in the original formation, must, in a short time, be completely locked together ; so that the gravel must lie on the surface in a loose state, or be pounded into sand, dust, or mud by the feet of horses, and attrition of carriages passing over it.

dies and precautions, care be taken to lop hedges and trees shading the road, to oblige occupiers of ground to have head ridges to their fields, and to scour their ditches along its sides, and to prevent them from dragging timber, or turning ploughs or harrows upon it, the means of keeping a road in repair may be said to have been enumerated. It should not be omitted, however, to mention the advantage of holding out encouragement for the use of carriages with broad wheels ; as the benefit of these, not only in preserving roads, but in repairing the injury which they receive from narrow-wheeled carriages, cannot be too highly appreciated by those who direct their attention to this important branch of the agricultural improvement of the country.

N.

ESSAY I

ON

CULINARY SALT:

WITH THE MEANS OF PURIFYING IT FROM SUBSTANCES
WHICH CONTAMINATE ITS QUALITIES.

Quod si sal infatuatus fuerit, quo salictur?

CULINARY SALT is of the most ancient and universal use. It is peculiarly grateful to the palate of man and domestic animals. By its antiseptic quality, provisions are preserved sound for future use and distant voyages. And it is also a material necessary in different branches of manufacture. The possession of this salt in a state of purity is therefore a matter of great importance.

This useful salt is obtained from three different substances, viz. Rock Salt, Salt Springs, and the Waters of the Sea.

1st, *Rock Salt*, as dug from the bowels of the earth, is found in irregular masses of a transparent, yellow, red, or blueish appearance; and it is also sometimes combined with the surrounding strata. †

When rock salt is found transparent, it is generally free from foreign mixture, and it does not deliquesce in the air. In this condition, it is pure culinary salt, and needs only to be triturated to a proper fineness, in order to render it fit for use. Those writers, therefore, who assert that *sal gemma*, or transparent rock salt, may be used with safety, are certainly right.

When this fossil is coloured with earthy or metallic substances, the debasement proceeds either from such substances being originally held in solution, by the excess of muriatic acid; or the foreign substances are accidentally enclosed, undissolved, in the water of crystallization.

† Werner classes all kinds of rock salt in two varieties.
1st, Lamellar. Its colour grey, yellow, reddish, or pearl grey, or brownish red; found in vast masses with conic impressions; also crystallized in cubes. External lustre casual. Internal, 2, 3, glassy. Transparency, 2, 3, 4. The surface of the crystals smooth when the lamellæ are entire. Fracture foliated. Hardness from 4 to 5, sometimes 8. Specific gravity 2.143, Brission.

2d, Fibrotus. Greyish white, partly yellowish grey, lavender blue, or flesh red, found in amorphous masses, in strata, or stalactitic. Lustre, 2. Transparency, 3, 4. Fracture slightly curved; rarely straight or diverging. Fragments, angular. Hardness, 5.

In the former case, the salt must be purified by a chemical process, of which we shall treat in the sequel. In the latter, nothing is necessary but to dissolve the whole in four times its weight of water, and allow the solution to rest for 12 hours. The impure substances will fall in sediment to the bottom of the vessel.

2d, *Salt Springs.* By these we understand those waters issuing from the bowels of the earth, which contain the solution of culinary salt in so great a proportion, as to bear the expense of evaporation in order to obtain the salt they contain. The water obtains the saline matter either by its solvent power in descending through strata impregnated with saline particles, or by its resting on, or washing, beds of rock salt, and dissolving a part of it as it passes along.

3d, *Water of the Sea.* From the ocean, the most plentiful supply of culinary salt is obtained. Sea water, with respect to the nature of its salts, and the proportion which they bear to one another, may be considered as nearly the same in all places, free from animal and vegetable matters, and other extraneous substances. The greatest bitterness of some salt waters, such as those of the dead sea, is owing to an uncommon proportion of the muriates of lime and magnesia, not to bitumen, as has been erroneously supposed.

The striking difference in the appearance of these three sources from which culinary salt is derived, might lead a superficial observer to con-

clude, that the salts derived from them are also different. But, from the short description given of the above three bodies, and in the sequel, it will appear evident that the salt which chiefly abounds in them is the same; and that it differs only by the foreign mixtures with which it is accidentally contaminated.

From this general view of the different subjects from which the salt in question is obtained, as they are presented to us by nature, it seems most proper to treat of the method of purifying salt in general, from whatever source it is derived, without making distinctions which are rather artificial than real.

This salt is a compound substance, called by chemists muriate of soda. According to Mr Kirwan it is composed of—

Pure mineral alkali or soda,	-	53 parts.
Muriatic acid,	-	39
Water,	-	8
		100

It is thus formed by art and by nature, according to the affinity which the ingredients of the composition have for each other. It is therefore in its most perfect state; and all attempts to amend it would be folly. But as this salt is frequently found mixed and contaminated with other substances, the ascertaining of those substances with which the different saline solutions may be united, will direct us to the proper agents for purifying them.

It is by earthy and metallic mixtures, as has been already observed, that rock salt is contaminated: and as it must have been originally in a state of solution, these substances must at that period have entered into its composition, and been held in solution by a superabundance of muriatic acid. Mr Kirwan, in his analysis of mineral waters, states, that the following combinations have been found in waters impregnated with muriatic acid, viz.

1. Silvian.
2. Sal ammonia.
3. Muriated barytes.
4. Muriated lime.
5. Muriated magnesia.
6. Muriated argil.
7. Muriated iron.
8. Muriated manganeze.

The 1st, 2d, and 3d of these substances are so uncommon in muriated waters, that it is unnecessary to treat of the means of freeing saline solutions from them; and besides, the poisonous nature of barytes renders any saline solution containing it an improper subject for the manufacture of salt. It is chiefly by the 4th and 5th that the compound muriated solutions are contaminated.

Iron is found chiefly in rock salt; and it is by the different proportions of this metal that the various shades of colour are communicated. The

existence of manganese in muriated solutions is still doubted by some chemists.

The component parts of sea water are very accurately given by Bergman. That which this excellent chemist analyzed was taken up at sixty fathoms beneath the surface, about the latitude of the Canaries. This water was intensely salt, had no smell, and was not so nauseous to the taste as water taken up at the surface. Its specific gravity was 1.0289. An English wine pint of 28.875 inches contained,

Muriate of soda	-	241 grains.
Muriate of magnesia	-	65.5
Sulphate of lime	-	8.
<hr/>		

Total of solid contents 314.5

besides a minute portion of carbonate of magnesia separated during the evaporation. These results give about 1 of solid contents to $23\frac{1}{4}$ of water. But on the shores of Great Britain, where the climate is moist, the exhalation moderate, and many fresh water rivers flowing into the sea, the proportion seldom exceeds 1 of salt for 30 of water. A pint of sea water on our coasts may therefore contain—

Muriate of soda	-	186.5 grains.
Muriate of magnesia	-	51.
Sulphate of lime	-	6.
<hr/>		

243.5, or

or half an ounce, three grains and a half of solid contents.

After taking this general view of the ingredients contained in the different natural bodies from which culinary salt is manufactured, it behoves us to inquire in which the antiseptic power, the most valuable quality of this salt, resides. Sir John Pringle, in forming a table of the antiseptic power of different salts, states that sal gemma, or pure transparent rock salt, possesses this quality in a higher degree than common salt. Now, this salt being free from foreign mixture, does not deliquesce in the air, as has been before stated ; which shows, that it is a perfect combination with just proportions of its constituent ingredients, and of course less liable to be acted upon by external agents. It must therefore be a genuine muriate of soda : and the freer of mixture this salt can be produced in manufacture, its quality will be more valuable.

It is true, indeed, that some have given common manufactured salt the preference to pure rock salt, for the preservation of provisions : But this must be a mistake. We know that neither sulphate of lime, nor muriate of magnesia, which always accompany common salt, possess any high degree of antiseptic power ; and therefore the antiseptic power of the salt with which they are mixed must be weakened. The most perfect muriatic salts are those which are least subject to undergo changes by the influence of the at-

mosphere : and the same have also been found to be the most proper for preserving provisions. *

The impurity of most of the common salt of the markets is discernible, 1st, by its tendency to deliquesce, or, as the common people call it, *run*; which always happens unless it be placed in a very dry situation: and, 2dly, by its disagreeable bitter taste, which it also communicates to such provisions as are seasoned with it. These defects are partly occasioned by the improper manner in which the salt is manufactured, and also from the matters contained in the sea water.

In the manufacture of salt, sufficient attention is not paid to the clarifying the sea water; and the processes of evaporation and crystallization are carried on in too hurried a manner. Hence the salt is so debased with improper mixtures, as considerably to impede its antiseptic power. I have repeatedly made a solution of 2 lib. of common salt got in the markets of the west of Scot-

* From some specimens of rock salt from Namptwich, the colour of which is dull yellow, pure white salt is obtained, by pounding and dissolving it in four times its weight of distilled water. On the solution remaining at rest for a few hours, an ochrey coloured precipitate falls to the bottom of the vessel. On drawing off the clear solution, and evaporating, pure salt is obtained. On examining a solution of pure sal gemma by tests; with oxalic acid it showed no indication of lime; with carbonate of soda, no magnesia; and with prussic acid, that it contained no iron.

land. Upon filtering the solution, the medium of the refuse I obtained was—

Uncombined magnesia	-	2 dw.	$\frac{1}{2}$	parts.
Sulphate of lime	-	0	12	
Fine sand	-	3	14	
Coaly matter	-	0	10	
		8	0	

being half an ounce of precipitate, or 1 lib. 9 oz. for every 100 lib. of salt.*

It has been questioned by some, if the proportion of magnesia combined in common salt, can be injurious to its quality. From the mild nature of this earth, it cannot indeed be so injurious as lime. But though it should not be directly injurious, yet as it is found to possess little or no antiseptic power, by combining with the antiseptic salt, it must tend to debase its quality, and therefore ought to be separated from the other.

The Dutch have paid more attention to the ~~the~~ quality of the salt they employ in the curing of ~~the~~ fish, than any other nation. In order to prevent ~~the~~ any being used of an improper quality, inspectors of salt are appointed at all the sea-ports, where ~~the~~ vessels are fitted out for the herring fishery, whose ~~the~~

* I cannot say where this salt was manufactured; it was ~~the~~ of a greyish unsightly appearance. Of some samples sent me ~~me~~ from the east of Scotland, the colour was whiter, the crystals ~~the~~ larger; although both showed equal disposition to deliquescence.

business it is to survey the salt shipped for this purpose, as well as that which is used on shore for repacking the herrings which are returned from the fishery. They have learned, from long experience, that the quality of the salt they use for this purpose is of great importance, and in the manufacture of it they take great care that it is freed from every substance which may hurt its antiseptic quality ; and in the evaporation of the saline solutions, sufficient time is allowed for the crystals of salt to form in a perfect manner ; and accordingly, salt may be purchased in Holland which has taken three, four, or six days for its formation ; or, as it is called in common language, salt of three, four, or six days' making, according as it is in demand.

We come now to inquire what is the most easy and effectual means of purifying salt from those substances with which it is contaminated. In general, we may here observe, that those agents which have the power of precipitating lime and magnesia from muriatic solutions, have also the power of precipitating every other combination which has been found in them, with the exception of ammonia and barytes. It is therefore unnecessary to treat of any method of freeing saline solutions from silex, argil, iron, or manganese ; because any agent which can be employed with advantage for the purifying of salt, has the power of precipitating all the substances before enumerated ; the affinity of the muriatic acid be-

ing greater with lime and magnesia, than with argil, iron, &c. ; so that when lime and magnesia are combined with any muriatic solution, the former substances cannot exist in any large proportion.

There are two substances which may be used with advantage for the refining of salt, which, instead of impairing its antiseptic power, considerably improve it. These are,

1st, Sweet whey.

2d, Carbonate of soda.

* It is with the first of these the Dutch refine the salt which they use with so much advantage in the herring fishery. The process is as follows. To every 100 lib. of common salt dissolved in rather more than three parts of water, they add about two gallons (wine measure) of sweet whey. A certain portion of this substance has the property of uniting with the lime or magnesia contained in the salt ; and, before the liquid boils, a thick scum of these earths appears on the surface of the liquid, which is carefully skimmed off, and thrown aside. When the evaporation is carried forward slowly, the salt forms in purity, is large grained, and of a fine flavour. Great care is taken that the evaporation is not carried too far because, besides the lime and magnesia which appears on the surface of the liquor as scum, another portion of these earths remains dissolved in

* See Appendix to this article, No. 3.

what is called the bittern, or last portion of the liquor. And it is a fact, well known to chemists, that when the crystallization of any salt is carried to an improper length, it is injured by part of the impure liquid or mother water adhering to and adulterating its quality, and from which it cannot be freed but by subsequent crystallization. But of this more in the sequel. From the simplicity of this process made use of by the Dutch in refining of salt, and from its efficacy for removing lime and magnesia from muriate solutions, it may be applied for purifying any muri-o-saline solution where these earths are combined, whether they are contained in sea-water, salt springs, or the solution of rock-salt. And the quantity of whey has only to be increased or diminished, according to the proportion of lime or magnesia existing in the saline solution.

The second substance mentioned as proper for refining of salt, was carbonate of soda.*

If, to 100 lib. of common salt dissolved in four parts of water boiling hot, 7 lib. of carbonate of soda are added, on allowing the solution to remain at rest for 12 hours, a precipitation of white matter will take place, which, when repeatedly washed in fresh water, and afterwards dried with a heat of 80 degrees of Fahrenheit's thermometer, will consist of about five lib. of carbonate of magnesia. On the saline solution being drawn

* See Appendix, No. 2.

off from the magnesia and evaporated, white salt of a very fair colour, and in a complete state of purity, will be procured. * By this method, not only common salt may be refined, but also salt water, salt springs, and solutions of rock salt, or any other impure saline mixture ; and it is only necessary to increase or diminish the proportion of carbonate of soda, according as the lime or magnesia abounds more or less in the solution. But although any solution containing culinary salt is rendered completely pure, by all the substances which contaminate them being precipitated by carbonate of soda, on evaporating with a very moderate heat, the crystals are always of a small grain ; so that they could not be used advantageously for the curing or repacking of fish. This gives the salt which is refined by whey a decided preference, as the crystals of salt, when the liquid is evaporated slowly, are always of a large grain. Now, as this salt is equally pure with that which is refined by soda, it will answer better as an antiseptic for the curing of fish, which is what is wanted ; but that which is refined by soda will not answer for curing any article of provision, where

* At first sight, this may appear a very expensive process ; in place of which, it is productive of profit. Pure soda may be purchased at present for 4*s.* per cwt. or about 4*d.* per lib. ; so that 7 lib. will cost 2*s.* 9*d.* Magnesia sells at 15*d.* per lib. in bulk : Besides, an increase of salt is obtained by the combination of the soda with the acid which helps the magnesia in solution.

The salt is required to be intimately mixed with the substance to be preserved.

Having ascertained the manner by which saline solutions, containing culinary salt, can be purified with facility from combinations with which they are usually contaminated, and pointed out the process whereby the Dutch refine the salt they use with so much advantage in the herring fishery, we come now to inquire, what is the most proper method of manufacturing salt, so as economy may go hand in hand with the procuring it in a pure state.

But before we proceed to this, it may be proper to notice the principal defects in the manufacture of salt from sea-water, as at present conducted. These are—

- 1st, The sea-water is not properly clarified;
- 2d, The evaporation is carried on too rapidly;
- 3d, Defective materials of which the evaporatory vessels are constructed.

1st, The sea-water is not properly clarified. This is evident from the impure sediment found in dissolving all common salt.† To ascertain the quality of refuse in it, nothing more is necessary than to dissolve a few pounds in pure water, and, on allowing it to remain at rest, a grey-coloured matter falls to the bottom of the vessel. On filtering the solution on a tin funnel through blossom

† For the quantity of refuse in common salt, see page 378.

paper, and washing the matter that is collected on it with fresh water, drying, and weighing it, the quantity is ascertained.

It is said that, at some salt works, the sea water used for the making of salt is not clarified at all; but that, on the vessels being filled with water, they immediately begin to evaporate briskly. In such a case, it is impossible but that the salt must be of a very inferior quality, from the heterogeneous mixture contained in sea-water taken up near the shore. However imperceptible the substances contained in it may be to the naked eye, they are not so to the taste; and in the case of sand, they are obvious not only to the sight, but may be felt. On this account, a proper time should be allowed for the sea-water to settle, so as the fine sand held in suspension by the agitation of the sea may subside. And where the common method of manufacturing salt is followed, the process of clarifying the solution by white ~~the~~ of eggs or bullocks' blood, ought to be strictly ~~to~~-y adhered unto; because, however imperfect these ~~the~~ methods are for fully clarifying salt water, yet ~~they~~ ~~set~~ they are certainly necessary for uniting with, and ~~and~~ removing much of the uncombined matters which ~~which~~ float in and contaminate sea-water.

2nd, The evaporation is carried forward too ~~too~~ rapidly. When the sea-water, by evaporation, ~~run~~, has acquired the density necessary for crystalliz ~~in~~ ing into salt, any impurity contained in it is sus ~~sus~~ pended with greater facility; and this is also aid ~~aid~~.

~~e~~d by the boiling of the liquid. Extraneous substances are thus thrown up to its surface, where, coming into contact with the crystals of salt as they are formed, they adhere unto, and fall down along with them. In this manner, all uncombined matters which are found in common salt, such as sand, magnesia, sulphate of lime, &c. are united with it.

~~3d~~, The material is defective from which the evaporatory vessels are made.

The form of the salt pans at present in use, has, from long experience, been found well calculated for the purpose to which it is applied, viz. the evaporating a certain quantity of sea-water at a cheap rate. But, at the same time, the pans themselves are not without defect. Being made of plate iron, the muriatic acid in the sea-water acts upon and corrodes them; and besides this, what the workmen call scratch (sulphate of lime), is precipitated on the bottom and sides of the vessel, from which, if it is not detached and removed, the vessel will be finally destroyed.

As the cost of fuel is a leading expense in the manufacture of salt, various methods have been proposed for procuring it at a cheaper rate than what is commonly followed in this manufacture, in order to lessen the expense of fuel. Of the many plans proposed, we shall only notice

Freezing saline solutions: And

Spontaneous evaporation.

In northern latitudes, it is common to expose sea-water in shallow pits during the frost of winter. By the extreme cold, the fresh water of the solution is congealed into ice, which is separated from the liquid. The remainder is, by such means, proportionally concentrated, and is then run into boilers and evaporated by fire, in order to gain the salt contained in it. This method is frequently followed in the northern parts of Russia, during the rigour of their long winter. But in Britain, the winter is seldom so severe as to insure success in procuring salt in this way; and freezing sea-water by artificial mixtures, is too expensive a process for the manufacture of salt.

The evaporation of fluids commences at about 40 degrees of Fahrenheit's thermometer. By spontaneous evaporation, we have the most completely formed salts, as the constituent parts of bodies then assume the qualities and forms assigned them by nature in the most perfect manner.

In the southern parts of England, particularly at Lymington in Hampshire, the evaporation of sea-water is carried forward so far, by first exposing it to the air in shallow pits lined with clay, by which it loses much of its superfluous water, and the saline solution becomes proportionally concentrated. The brine is afterwards boiled down, until the muriate of soda is crystallized.

In the northern parts of France, the sea-water is pumped into large cisterns at the top of a shored

open at the sides, in order to admit a current of air; and the water is made to fall through stop-cocks on brush-wood, by which it is minutely divided; the air having free access through the shed, carries off part of the superfluous water. This process is continued until the water acquires a certain density, when it is run into boilers, and further evaporated, in order to gain the salt contained in it.

Bishop Watson, in his Chemical Essays, * proposes a method whereby spontaneous evaporation may be accelerated, by increasing the surface to be acted upon, and thereby concentrating sea-water or other saline solutions.

Having immersed a yard square of woollen cloth in water, so as not to drip; in this state it was exposed to a warm sun, in June, in a hanging posture, when there happened to be but little wind, so as the sun and air had free access to it. It became nearly dry in an hour, and, in that space of time, lost 8 ounces of its weight. On another occasion, with a bright sun and high wind, it lost 6 ounces of weight in one quarter of an hour. From which he concludes, that, if it had been constantly wetted, it would have lost, by evaporation, 24 pounds in 16 hours. He then supposes one man to manage, by mechanical contrivances, the keeping of one thousand yards of

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* Vol. II. p. 57th, London.

more of cloth constantly wetted; and by this plan there would be evaporated, in favourable weather, twenty-four thousand pounds of water; and, supposing sea-water to contain one thirty-second part of salt, it would give at the rate of 750 lib. of salt per day.

Where the climate is favourable, and a succession of dry weather can be depended upon, these, or similar methods for accelerating evaporation, may be adopted with considerable advantage. But, in North Britain, the coldness of the climate, the humidity of the atmosphere, and the general inconstancy of the weather, are unfavourable to adopting the means of spontaneous evaporation as a certain method of gaining salt, by the foregoing, or such like plans, for forwarding the process. We must therefore adopt such other means as are in our power for accelerating evaporation, in such a manner as will insure success, without being dependent on the variations of the weather, by which the operations of this necessary and valuable manufacture might be retarded.

Among the many improvements which modern industry has added to the arts, there are few which ranks higher than the application of steam for a variety of useful purposes. And it will require very little ingenuity to adapt it for the process of evaporating and crystallizing common salt, or other saline solutions.

Steam, from its elasticity, can be directed to any given point; and, by the proper direction of

At, we can apply it again to evaporate any other fluid. It is of the same temperature with boiling water, and occupies about 1200 times the space that water does. According to Mr Watt, in this state it contains about 1000 times more caloric than its weight of water. By means of it, therefore, we can apply the same heat in a double capacity.

It was before observed, that violent boiling is by no means calculated for the crystallizing of common salt ; because any impurities which are contained in the water, are so much agitated as to be thrown up to the surface of the liquid, where they come into contact with the salt as it forms on the surface, and they are attached to, and fall down along with it, as it is crystallized. By the application of steam for evaporation, this will be in a great measure avoided ; because any vessel to which steam is applied for evaporation, never comes to the heat of 212 degrees, the point at which water boils, as will be shown afterwards. But the heat communicated by means of steam is so regular, that it ensures evaporation nearly equal to the same fluid when gently boiling. Now, as, by the increased quantity of caloric of fluidity contained in steam, we can apply it to a greater surface of evaporatory vessels, by this means the quantity of fluid evaporated will certainly exceed the quantity of steam thrown off by the common methods of evaporation. But, independent of this, the quality of the salt, whe-

ther common or refined, is superior to that which is manufactured by the common process, as will be shown in the sequel.

On account of the corrosive quality of solutions of salt, acting upon, and destroying salt pans which are made from iron plates, it has been frequently suggested, that leaden boilers would answer far better for the evaporation of muriosaline solutions, this metal being peculiarly adapted to this purpose, as it is not acted upon by the muriatic acid when in the regular state. But lead cannot be used for evaporation by fire, on account of its being so very easily melted. But steam presents a medium by which this metal may be acted on with safety; as there is here no risk of fusion, and as it is not corroded by the muriatic acid. Should any unforeseen accident happen to vessels of this metal, they will bring nearly the same price as when first erected, which is no small advantage in point of economy. †

In order to ascertain the degree of heat communicated by steam to a solution of salt in a given time, I had a small apparatus made, of the construction of fig. 1. of the Plate here presented;—for a description whereof see note at foot of next page.

† A leaden vessel for evaporation, weighing 10 lib. per square foot, the dimensions of which are 18 feet long, 10 feet wide, and 2 feet deep, will weigh about 1½ ton, which, at 25*l.* per ton, makes the cost of the vessel 52*l.* 10*s.* The present price of unwrought lead is 50*l.* per ton.

Fig. 1.

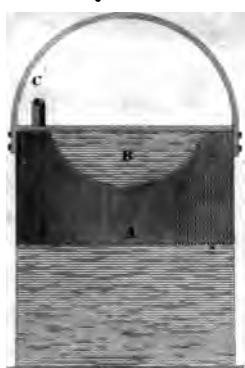


Fig. 2.

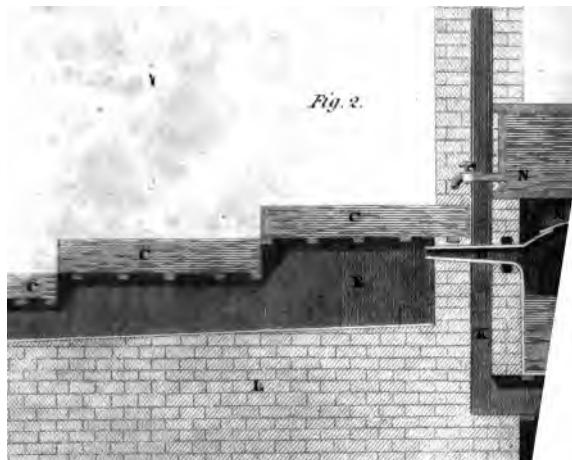


Fig. 3.



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From several experiments, as under, the medium heat to which the solution of salt was raised in the upper vessel, by Fahrenheit's thermometer, is

Time.	Heat of the Solution.
In 10 minutes	142 degrees.
15	171
20	182
25	195
30	202

The solution of salt was 60 degrees when put on the fire ; in 20 minutes the liquid in the under vessel was boiling ; after 30 minutes the solution in the evaporating vessel received no further increase of temperature ; and at this period it was evaporated one-eleventh part, and salt formed of a very perfect quality. Although the above experiment has every advantage in its favour, with regard to a sufficiency of steam being applied, in order to keep the evaporatory vessel

Description of Fig. 1. before referred to.

The under vessel or boiler was filled with a solution of salt up to the height of the dotted line at A ; the cover is fitted close, and has an inverted circular dish B, open at the top, soldered into it ; this is also filled with a solution of salt. In the cover of the vessel is a small tube, C, in order to allow the steam to escape. As soon as the water in the boiler throws off steam, the heat is communicated to the solution in the dish B ; and when the solutions of salt are at saturation, crystals immediately begin to be formed. As the vessel is very small, and contains only about 3 English gallons, with a brisk fire it soon boils.

at as high a temperature as the nature of the operation can command; on a large scale there is no doubt of its success also; at any rate it is certain we cannot procure salt of a large grain, unless the liquid be under the boiling point of 212 degrees; because the motion of the boiling liquid wets the upper surfaces of the crystals as they are forming, when they immediately fall to the bottom of the pan. That a lower heat is necessary for the formation of muriate of soda in perfection, than that which is commonly employed in this country, will appear evident, when we consider, that it is probable that nature has originally formed rock salt into those large masses in which it is found, by an almost imperceptible evaporation. Bay salt is also formed into comparatively large crystals, by the gradual exhalation of the fresh water from sea water by the heat of the sun; and the Dutch make better salt than the British, by the superior attention they pay to the evaporation and crystallization of the salt which they employ for the curing of fish,

By the drawing (fig. 2.) I do not pretend to exhibit the most advantageous method in which steam can be applied for evaporation on a large scale, but to point out that which appears as the most simple, and which has the advantage of being erected on any given scale.

The principal parts of the machinery consist of a cistern, A, which contains a purified solution of salt, of so large a capacity as to supply the

steam boiler B, and the evaporatory vessels CCC, with the saline solution.

From the cistern A, a pipe, F, is conducted into the boiler, fitted up with valves in the same manner as those which supply the boiler of a steam engine, the manner of doing which is known to every engineer; so as a regular quantity of water may supply the consumption of steam which flies off.

From the cistern another pipe, N, with a stop cock, is carried, in order to fill the evaporatory vessels CCC, with the saline solution at pleasure.

Could the attention of the workmen be depended upon, the boiler might be made of cast-iron, which is not so easily corroded by the solution of the muriate of soda as plate iron; but when cold liquids are put into it before being sufficiently cooled, it is in danger of being rent by the unequal contraction of the metal.

The boiler (which must be of so large a size as will give a sufficiency of steam for heating the evaporatory vessels CCC) has an open pipe, D, for allowing the steam to escape into the steam chamber E; and also a stop cock G, for running off the solution in the boiler when it is sufficiently concentrated. It must also have what engineers call a man hole, M, so large as to admit a person occasionally into the boiler, in order to clean it out; this is secured by an iron plate, luted with coarse woollen cloth, and screwed firmly to the boiler to prevent the escape of steam.

The evaporatory vessels CCC, are made of

sheet lead, placed in wood, with which the steam chamber E is lined ; the edges of these vessels are turned over the wood, and luted with coarse woollen cloth, in order to prevent the escape of steam : the whole is built firm in brick ; the vessels are supported by beams of wood placed across the steam chamber ; and the wood is laid well over with pitch, in order to prevent its being rotted by the steam. The solid masonry L, must be made with a gradual declination as it recedes from the boiler ; at the further extremity of which an opening must be left, in order to give a current to the steam, as well as to allow the water to run off when condensed.

The cistern A being filled with a purified solution of salt, and the boiler filled to O with a solution which is wanted to be farther concentrated, and a sufficient quantity of purified solution in the evaporatory vessels CCC, as soon as fire is put into the furnace H, the liquid is heated in the boiler ; and the steam having vent through the pipe D, it fills the steam chamber E, by which the evaporatory vessels CCC are heated as the steam passes along. The evaporatory pans are placed alternately lower, in the form of steps, as they recede from the boiler, in order that as much surface as possible may be presented to the action of the steam ; and as its volume will gradually decrease, by being in part condensed at its greatest distance from the boiler, the evaporatory vessel furthest distant, by being placed in this manner, will have as much benefit from the

remaining steam as possible. When the evaporatory vessels are filled with a purified solution of salt at saturation, a very short time will elapse after they are heated, until salt begin to crystallize on the surface ; and by the regular and gradual evaporation, it will be found of a very superior quality, both with regard to the size of the crystals, and such other valuable properties as constitute a perfect muriate of soda.

By means of the stop cock N, the evaporatory vessels may be regularly supplied with more saline liquor, as the salt is formed ; and, at a proper height, stop cocks may be placed, whereby the liquid may run from the vessel nearest the boiler, into that which is most distant, so as labour may be avoided in filling them separately. The range of evaporatory vessels may be continued to such a distance, as admits of their receiving benefit in being heated by the steam ; and more steam boilers than one may be erected where the works are large, so as there may be no suspension in carrying forward the making of salt. And it is perhaps possible to have the whole apparatus so graduated, that the saline liquid contained in the cistern may regularly supply the whole consumpt by evaporation.

From what has been advanced we conclude,
1st; That in order to obtain pure salt, the solutions of rock salt, salt springs, or sea water, must be freed from such improper mixtures as contaminate their qualities.

2d, That pure salt can be obtained by precipitating, by carbonate of soda, those substances which contaminate any solution containing muriate of soda.

3d, That by means of a certain proportion of sweet whey, solutions of common salt are completely purified from the remaining lime and magnesia, with which it is always combined, and which counteract its effects as an antiseptic salt.

4th, That by employing steam for the evaporation of solutions of muriate of soda, the same heat effects a double purpose ; and crystals of salt are obtained of a larger grain than by the common process employed in the manufacture of it.

5th, That where steam is used, the manufacturer of salt may employ leaden vessels for evaporation, which are not corroded by the muriatic acid contained in the solution ; and in consequence he will derive advantage ultimately, from these vessels seldom needing repair.

On a review of the whole, I am sensible I have not strictly followed the orders of the Society, in treating of the subjects pointed out by them separately ; but this proceeds in some measure from the nature of the subject, it being universally allowed by all chemists, that muriate of soda, whether found in the state of rock salt, salt springs, or the water of the ocean, when freed from extraneous matters, possesses precisely the same properties and qualities.

APPENDIX**to****PRECEDING ARTICLE.**

No. I.

COMMON SALT, crystallized by art, assumes various forms, according to the mode of crystallization, and the purity of the water in which it is dissolved. Sometimes it presents cubes, sometimes quadrangular octagons like alum, and sometimes quadrangular pyramids. Care must therefore be taken of the quality of the water in which rock salt, or common salt, are dissolved, for being further purified. When common salt which was completely purified, or pure sal gemma, were dissolved in water which contained carbonate of lime, * the crystals, on being viewed through a microscope, had the appearance of the drawing. See fig. 3. of Plate, facing p. 391.

* Water from the common wells in Glasgow, which contain much of this combination.

A white streak is visible on one of the flat sides, in the form of what is called Saint Andrew's cross; from the angles in the lower side the same opaque streak rises and joins the cross exactly in the centre at A; when turned on edge, the crystal has the appearance as the side B. The crystals of common marine salt assume the same appearance, from the magnesia or lime contained in them.

When pure rock salt was dissolved in distilled water, the crystals were perfect transparent cubes. Hence the effect the purity of water has on the crystallization of this salt.

No. II. *Refining Salt by Soda.*

If to 20 pounds of common salt, dissolved in pure water, something less than 2 lib. of carbonate of soda be added, a white precipitate will be formed, which, when well washed and dried at 80, consists of

Magnesia, about	-	$7\frac{1}{2}$ parts.
Carbonic acid	-	$3\frac{1}{2}$
Water	-	$4\frac{1}{2}$

16 ounces.

By this it appears that common salt is composed of

Mineral alkali	-	-	-	51
Magnesia	-	-	-	2
Muriatic acid	-	-	-	39
Water	-	-	-	8
				100

In some respects, therefore, common salt may be accounted a triple salt ; and magnesia will crystallize with it in a larger proportion, by addition of more acid.

No. III. *Refining Salt by Whey.*

Sweet whey is used in Holland along with the solutions of salt they intend to purify. It has the property of separating lime and magnesia from muriatic solutions : this was first discovered by Scheele. When added to a solution of common salt, it separates part of the magnesia contained in it in the form of a thick scum ; but by far the greatest proportion of this earth is retained by it in the mother water, and will be found therein, in a very large proportion, after the muriate of soda is crystallized.

Saccharo-lactic acid answers the same purpose as whey, for purifying salt containing lime or magnesia. It is prepared in Switzerland in large quantities, by inspissating whey, and crystallizing it. It has a weak saccharine taste, and forms solid crystalline masses, not decaying in the air.

In those parts of this country where cheese is made in quantity, the whey might be evaporated, crystallized, and collected for sale, if encouragement offered. Three pounds of sacchro-lactic acid, or two gallons (wine measure) of whey, for refining 100 lib. of common salt, is sufficient.

No. IV. *Purifying Salt Springs.*

In Mr Kirwan's Essay on Mineral Waters, page 258, several processes are given, whereby the depuration and augmentation of common salt, contained in brine springs, may be accelerated. It is an improvement on what Gren published in the fourth volume of his journal.

' 1st, If 60 grains of slackened lime be dissolved in as much muriatic acid as is necessary for saturation, and 125 grains of desiccated glauber salt, in a sufficiency of water, and both solutions mixed and agitated, these salts will decompose each other; sulphate of lime will be precipitated; and on decanting the clear liquid, on evaporation, common salt will be formed.

' 2d, Let 240 grains of aërated magnesia be dissolved to saturation in muriatic acid, to which add 150 grains of slackened lime diluted with water, and 240 grains of dry effloresced glauber, and let them be agitated; after some time, and frequent agitation, the lime decomposes the magnesia; but the muriated lime thus formed, is,

in its turn, immediately decomposed by the glauber; and common salt and selenite is formed: Thus the magnesia is left single; and most of the selenite, as being little soluble, falls down with it, and both may be filtered off.

Hence improvements may be made in the five following cases.

1st, If the brine contains common salt and muriated lime only; in such case the addition of glauber is necessary; as more common salt is produced; and the selenite, being scarcely soluble, falls down.

2d, If the brine contains, besides common salt, also glauber and muriated magnesia; in such case, lime only need be added; as muriated lime will be formed, which is decomposed by the glauber; and selenite and pure magnesia will be precipitated.

3d, If the brine contain common salt, epsom; and muriated magnesia only; then an addition of both glauber and lime will be proper: The lime is wanting to decompose the muriated magnesia, and prevent the permanent existence of muriated lime, which would be as hurtful as the muriated magnesia.

4th, If the brine contain only common salt, muriated lime, and muriated magnesia, here also both lime and glauber must be added; the lime to decompose the muriated magnesia, and the glauber to decompose the muriated lime.

' thus formed, and convert it into selenite. Glauber alone would indeed decompose both the muriates; but then epsom would be formed, which is difficultly separated from common salt.

' 5th, If the brine contain common salt, epsom, muriated magnesia, and glauber; then the addition of lime only will be sufficient, if the glauber were in sufficient proportion; otherwise, some should be added.

' To these we may add the case in which common salt and epsom only are found, and then the addition of lime singly is useful; and the case in which aerated alkali is found, in which case the mixture of other brine, containing earthy muriates or sea water, is proper.'

When glauber salt and muriated lime are needed in quantity, for the foregoing purposes as specified by Mr Kirwan; it may be necessary, in order to procure them at a cheap rate, to decompose common salt by means of sulphuric acid, so as muriatic acid may be procured for making muriate of lime: The residuum, by solution and crystallization, will furnish abundance of glauber-

No. V.

It is well known that air, at a high temperature, is capable of uniting with, and holding in suspension, a considerable quantity of water. Saussure, in his Hygrometrical Essays, has give

A Table, exhibiting the different quantities of water, in grains, contained in a cubic foot of air. As this Table is the most perfect that has appeared, a copy of it is here presented.

Degrees of Hygro- meter.	Temperature.								
	10°	21°	32°	43°	54°	60°	77°	88°	100°
40	1.8971	1.1067	1.3653	1.6843	2.0779	2.5634	3.1625	3.9016	4.8134
45	1.0676	1.3171	1.8248	2.0045	2.4739	2.9952	3.6952	4.5588	5.6241
50	1.2197	1.5047	1.8563	2.2900	2.8251	3.4852	4.2997	5.3045	6.5442
55	1.4116	1.7414	2.1483	2.6503	3.2696	4.0335	4.9761	6.1390	7.5737
60	1.6411	2.0246	2.4976	3.0590	3.7737	4.6554	5.7454	7.0856	8.7415
65	1.9204	2.3691	2.9926	3.6055	4.4480	5.4873	6.7697	8.3518	10.3036
70	2.2277	2.7482	3.3903	4.1824	5.1596	6.3651	7.8526	9.6878	11.9518
75	2.5215	3.1107	3.8375	4.7342	5.8404	7.2050	8.8888	10.9661	13.5289
80	2.8155	3.4734	4.2850	5.2862	6.5213	8.0450	9.9251	12.2446	15.1062
85	3.1095	3.8361	4.7324	5.8381	7.2092	8.8850	10.9614	13.5231	16.6834
90	3.4035	4.1987	5.1797	6.3900	7.8831	9.7250	11.9977	14.8016	18.2607
95	3.6946	4.5578	5.6297	6.9420	8.5640	10.5650	13.0340	16.0600	19.8379
98	3.8739	4.7790	5.8956	7.2731	8.9725	11.0690	13.6558	16.8472	20.7844

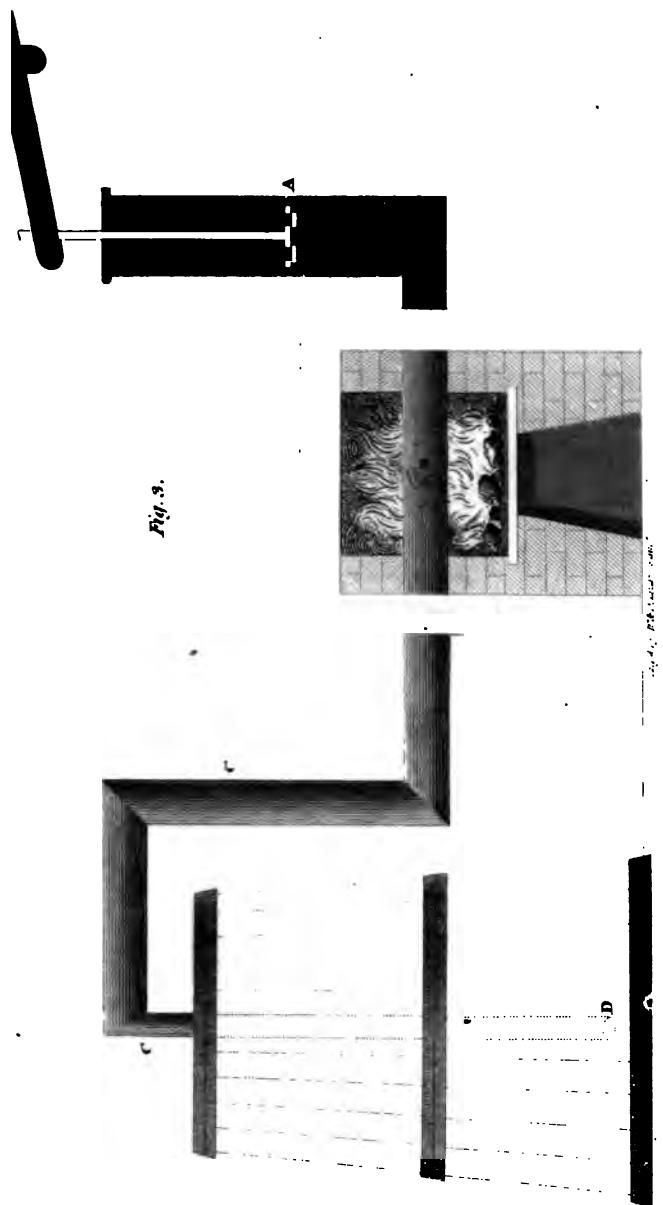
Mr Wedgewood, with an apparatus constructed on purpose, heated gold wire to redness by means of heated air. At this high degree of temperature, by comparison with the foregoing Table of Saussure, we may form some faint idea of the quantity of water it could have held in solution.

On these data, it is certainly possible to em-

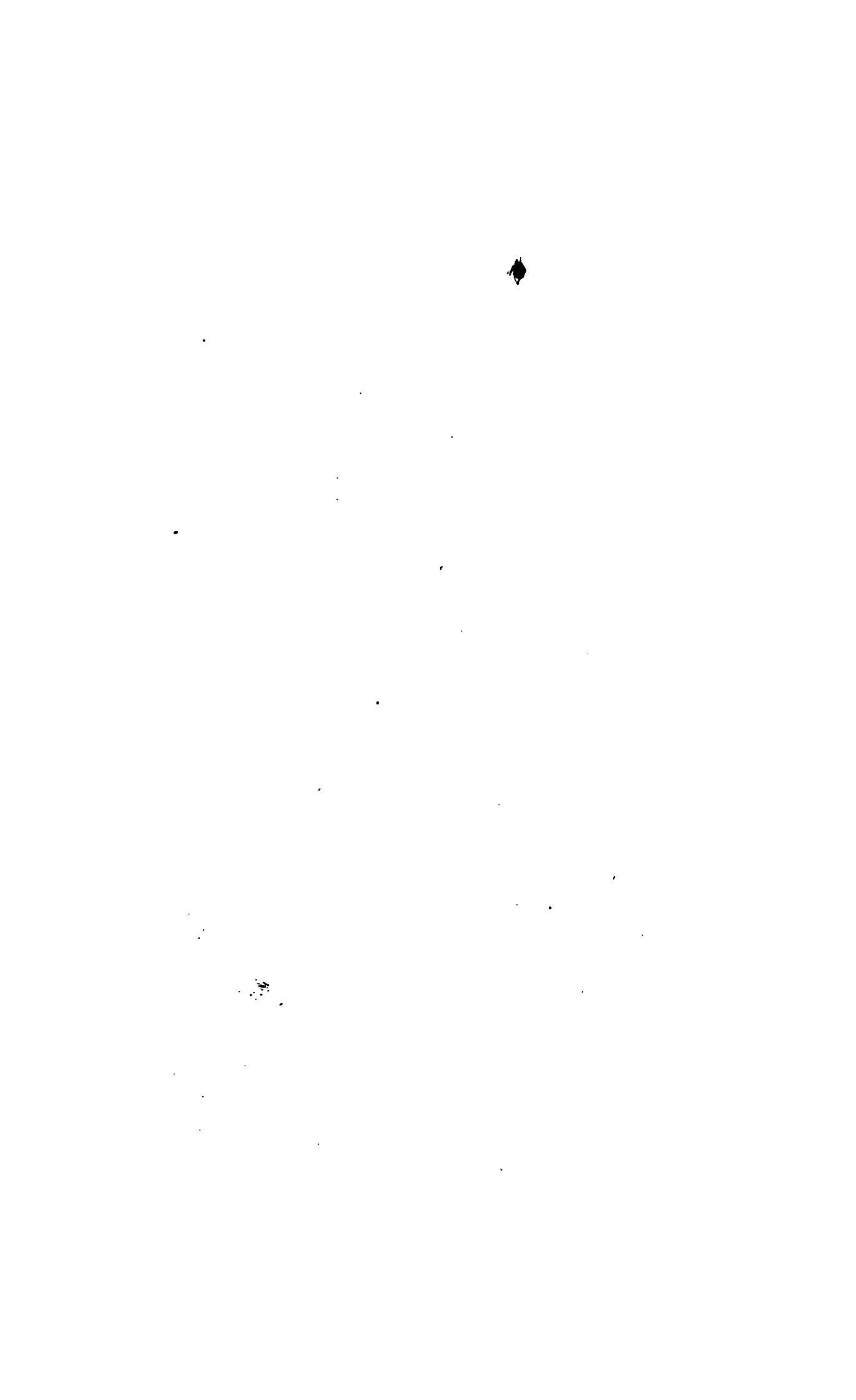
ploy air at a high temperature for the evaporation of liquids ; and by a proper construction of machinery, in extensive works where a steam engine or other power is employed, to use the same fuel for evaporating by air, fire, and steam.

To those who have not seen a drawing of Mr Wedgewood's apparatus for heating air, the sketch annexed will convey an idea of the manner in which it may be applied for the evaporation of liquids.

On this principle, a column of air is forced by the pump A (whose valves open inwards, so that when the handle of the pump is drawn upwards it may admit fresh air) through the pipe B, which passes through a furnace where the air is heated ; this pipe is continued, C C, into the conical vessel D, where the hot air is discharged at the bottom of the vessel, and in its passage upwards, unites its calorific with the water, and carries a part along with it in the state of steam. By two bellows of this kind working alternately into the cylinder B, a perpetual current of hot air will be pressed through the liquid. At first sight it will appear evident, that vessels made of a conical shape will be most advantageous for evaporation by hot air, because the air will then come into contact with the greatest possible surface of water in its passage through it. These vessels may be made of wood, firmly hooped, and lined with sheet lead. It may be also necessary to have obstructions in the inside of the pipe B, where it passes through



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the furnace; so as the air, by beating against them, may be heated to as high a temperature as possible; and the cylinder A may be surrounded with a body of water, in order to keep the valves from being destroyed.

But all that is intended by the foregoing sketch, is to point out the principle by which fluids may be evaporated by means of heated air, and not to give a perfect plan on which machinery for executing the purpose, should be erected. The putting this into practice is left to the ingenuity of the mechanic: and it is not foreign to the subject on which we have treated, to suggest any improvements which may be adopted for the evaporation of saline fluids, and for the saving of fuel.

ESSAY II.

ON A METHOD OF MAKING A PURE SALT
FROM SEA-WATER.

Scribere jussit amor patriæ.

SOME time ago, I observed a list of premiums offered by the Highland Society of Scotland, for an approved Essay on Salt.

One of the articles was, for the most approved mode of rectifying the common salt; and another for making salt from sea-water direct, both of equal purity with the Dutch salt used in curing of fish.

It was not my intention, at one period, to have become a competitor on this subject, being well aware that many members of this Honourable Society were much more adequate to the task than I could pretend to be: But, having mentioned some facts to a friend, I was induced to

~~Commit my thoughts to paper on the subject, in
as far as I had some theory, and a little prac-
tice.~~

It is apprehended, that as the Society require salt equal in purity to Dutch salt, if the muriate of soda be disengaged, their intention will be fully accomplished, provided this can be effected cheap enough.

The first objection that presents itself to the process of making salt in this country from sea-water, is the mode of receiving the water into the grand reservoir, at least on all parts of the coast which has not a long and extended range of rock. It is evident, that wherever a salt pan is erected, where the pipe leading to the reservoir ends in a shallow, sandy, or clayey soil, much sand and mud must be raised by the action of the waves, and, of necessity, part of it is carried into the reservoir itself. Where the coast is rocky for any extent, but, more especially, if the water be deep, and, consequently does not recede far from the main pipe, the water must be tolerably clear; but, on the contrary, when the pipe, as said before, ends in a shallow, sandy, or clayey soil, it demands a remedy, to have all the advantages of a rocky coast; and I imagine this remedy can be had in the following simple manner.— Let the end of the pipe opening into the sea be enclosed by a wooden box of 2½ or 3 feet square, and of a convenient height, perforated with holes of the diameter of a common gimlet, through

which holes a red-hot iron should be passed, to harden the inside surface, and prevent closing by the swelling of the wood. Suffer no water to get in but by these holes; and provide a lid with hinges as in a common chest. Let the lid be also perforated, and fixed down by a padlock if necessary. This box, which encloses the open end of the pipe, is then to be rammed hard with straw, and the lid locked down. The box is to be examined weekly, and, if necessary, supplied with new straw, and cleared of sand, &c. I mention this mode of excluding the sand, clay, &c, from experience.—So much for the conducting of the water.

The second objection is, that the lower orifices of the pumps which are inserted into the reservoir, are placed too near the bottom; by which error, whether the reservoir be full or not, the muddy part lying deeper than the clear water, must of necessity be pumped up at all times, and lodged in the pan.

The third and principal objection is, the preposterous manner by which the workmen set about evaporating. To make this evident, it is necessary to mention, at this stage of the inquiry, what is well known among chemists, viz, the constituent parts of sea-water. It is composed of various proportions of magnesia, combined with the muriatic and sulphuric acids; of soda, or the marine alkali, combined with these acids; and of a limy substance, now known to be of the

lime fixture as plaster of Paris or sulphat of lime. With this heterogeneous fluid, along with abundance of clay and sand, the salters set to work!—What is the consequence? The salt, even what is called flour salt, is overloaded with the sulphat of magnesia, which will continue to drop from it for several months; and the salt is thereby a perishable article in the hands of the holder, by the decrease of weight. But although it be allowed to drop its last, it will not be much purer; for still there is an exuberance of sulphat of magnesia in the crystalline form, besides muriate of lime, both of which are extremely bitter; and lime is known to be absolutely *septic*—a quality diametrically opposite to what is wanted in the curing of provisions.

To obviate the above inconveniences, I beg leave to submit to the Honourable Society the method I have followed in some experiments, with their results.

I take any quantity of sea-water got from the reservoir by the above mentioned mode of conducting the water through the main pipe, which water I bring to a pellicle in a common wrought iron pan, well seasoned. To this liquid, while hot, I add as much of the following composition, marked A 1 or A 2, as will precipitate all the magnesia, which is to be ascertained by filling a wine-glass of the mass in the pan (which must be previously well stirred and mixed), and drawing off into another wine-glass the supernatant liquor,

by means of a clean flannel rag, used syphon fashion ; great care being taken, that what comes over by means of the rag be transparent, and not mixed with feculencies from the full glass. If, then a *clear* solution of soda and water, or kelp water, be presented to it, and no precipitate formed, you have got clear of the magnesia ; otherwise you must give the mass in the pan an additional dose of the composition A 1 or A 2, great care being taken that the mass shall not have an excess of the composition, otherwise the muriatic acid in it will be so obtunded as to defeat the process of salt-making.

In all cases, agitating the materials is indispensably necessary.

COMPOSITION A 1 above referred to.

Take equal parts of quicklime (not the carbonat) and kelp bruised small, if it can be done conveniently, and mix them up in a hogshead, or any large close vessel, with soft water, to the consistence of butter-milk. This mixture being well agitated, (which is also to be done in the act of using it), is to be bunged up, and excluded from the air.

Or a COMPOSITION, A 2, less caustic, may be made as follows.

Equal parts of limeshells fallen down by the

Mr, *i. e.* carbonat of lime, mixed as above, and kept in an *open* vessel, will answer; but only more of it will be required, and strongly agitated while presenting to the hot liquor in the pan; for I find, by many experiments, that it is of the last importance the lime should be put in, *in substance*, and not as lime-water.*

THEORY.

The lime or its carbonat added to the hot liquor in the pan, produced from sea-water, will seize the muriat of magnesia, † and form muriat of lime; while the caustic lie of the kelp ‡ will seize the sulphat of magnesia, the only acid it is now combined with, and form sulphat of soda. Hence we now have,

1st, A precipitate of magnesia.

2nd, Sulphat and muriat of soda, both increased in quantity by addition of the kelp.
And,

3d, Muriat of lime.

* This perhaps may be explained upon the principle, that in 680 parts of lime-water, only one of lime in substance is to be found.—*Kirwan*.

† *Vide De Morveau's Numerical Table of Attractions.*

‡ Kelp is of the same nature as soda; is made from varec, commonly called wrack, and contains, *ready formed*, both the muriate of soda or common salt, and sulphat of soda or Glauconer's salt.—See Analysis of Barilla by Mr Kirwan, page 377 of Notes on Fourcroy's Chemistry by Thomson, vol. I.

But we have perhaps the first authority in Europe, that these liquors cannot remain in contact; for the muriat of lime will instantly seize the sulphat of soda,* and convert the whole solution into true muriat of soda or culinary salt, and sulphat of lime mixed with magnesia; which foreign matter is constantly separated in the process of boiling, and known to the workmen by the name of *pan scratch*.

From the above theory, founded on the first authorities already referred to, nothing is now required but to free the mixture from whatever is heterogeneous, so that nothing may remain but the *pure* muriat of soda or culinary salt disengaged; for which purpose, nothing more is necessary, than to allow the liquor in the pan (or wherever it was thus prepared) to clarify by standing. Draw it off with the *utmost possible care*, by a syphon, into a well seasoned pan, and evaporate *slowly*. And here it is of much consequence to remark, that if the previous steps have been carefully followed, and the liquor drawn off *very clear*, every drop of the fluid can be converted into real salt, and not a vestige of

* Thomson's Fourcroy, vol. II. p. 23.—‘Calcareous muriat decomposes the sulphats of potash and *soda*.’ It does not appear that this fact had been generally understood; for Fourcroy himself takes some pains to explain how it happens; and he mentions one property of the muriat of lime, which is so surprising, as to be called the *Chemical Miracle*.

the bitter matter left in the pan. By this mode, I have in my possession the most beautiful specimens of salt, (affording no precipitate with an alkali), both by quick and slow evaporation, even to crystals of an inch square, and of the most regular geometrical figure, exactly in the form of a mill-hopper, as described by Fourcroy; and I have the satisfaction to find, that even the small salt which I have made, and exposed to the air of a room without a fire, has preserved its dryness for several months; which corresponds exactly to the definition given of muriat of soda by Fourcroy, page 465.

Although (in order to procure the culinary salt in purity, the above mentioned heterogeneous substances must be got rid of, they can, nevertheless, be turned to great advantage, even so much so as to triple the profit in a salt manufactory of pure material; and this I have actually ascertained, both by accurate experiments, as well as by calculations I have made; but as this was not required by the Society in their list of premiums, it might have been thought superfluous to have entered upon the subject here. One fact, however, presents itself; which is, that it is impossible to make any quantity of salt *alone*, by the mode recommended in this Essay, so cheap as the same quantity of coarse salt can be made by the common methods followed in the salt pans; and it is presumed none of the members of the Society think it possible: But it can be demonstrated, that if the manufacture of salt, by which

is meant pure muriait of soda, was carried on in a scientific manner, by recovering and bringing to market the heterogeneous substances, any additional expense in the proposed method, compared to the present mode of salt-making, would not only vanish, but a handsome return to the proprietors would be the result: And I am very much afraid, that, without converting these materials, or some of them, to use, that all attempts to make what is really and truly pure salt, at a moderate rate, will be in vain; as the following estimate shows.

ESTIMATE of the EXPENSE of making, by repeated Trials, one Bushel of the Salt above recommended, on the supposition that the heterogeneous Substances are thrown away as useless.

$\frac{1}{2}$ cwt. of kelp produced, by five different experiments, a medium quantity of $58\frac{1}{2}$ lib. avoirdupois, which, at the rate of 6s. per bushel of 56 lib., the price of flour-salt at Sir John Hope's pans, including duty, amounts to L.0 6 2 $\frac{1}{2}$

The probable sale of $\frac{1}{2}$ cwt. of refuse of lime used in the operation, estimated so low as 2s. per cartload of 12 cwt. for a manure. This, on 56 lib. of salt, comes to 0 0 2

Produce of salt, &c. on $\frac{1}{2}$ cwt. kelp, if the heterogeneous matters are thrown away L.0 6 4 $\frac{1}{2}$

Produce of salt, &c. brought over, L.0 6 4½

Charge on the above.

To $\frac{1}{2}$ cwt. best kelp, at 6l. 10s. per ton
of 20 cwt. used in making the above
salt, which equals 3s. 1 $\frac{1}{2}$ d. per bushel
of salt, at 56 lib. avoirdou-

pois, is - - - L.0 3 3

To $\frac{1}{2}$ cwt. of lime used, at 6s.

per cart-load of 12 cwt. 0 0 6

To king's duty, workmen,
and fuel, the same as mak-
ing salt in the common
way, for one bushel - - -

L.

But if the materials be turned to mar-
ket, which were in the last case
thrown away; after deducting ex-
penses of manufacture, add - - 0 12 0

Total - - - L.0 18 4½
which will be the produce on 1 bushel of salt, if
the materials are saved.

It is submitted to the Honourable Society,
that although the foregoing estimate, which has
been made by accurate experiments, at sundry
and different times and temperatures, is very high
in price, to procure *real and true muriat of soda*,
yet as the strength or purity of the Dutch salt is

not condescended on, and even the principle on which it is made doubted, * a proportionally *less* quantity of kelp might be used, to bring out a material *equal* at least to the Dutch salt in curing of fish, and thus reduce the expense of kelp from 3s. 1½d. per bushel of salt, to perhaps one half, or one quarter, that sum ; for, at 3s. 1½d. for every bushel, we can always procure salt *disengaged from all its impurities* ; and therefore, every inferior dose of the composition (p. 410) is in our power, for common salt of all degrees ; and thus we might have the salt of this country one-fourth part refined, one-half part, three-fourth parts, or wholly : and it is to be remarked, that the residuum, which is a full cwt. for every bushel of pure salt, and proportionally less when salt of lesser purity is made, might be an article of ready sale as manure, being a composition of lime, &c. ; and indeed, since sulphat of lime is the same as plaster of Paris, why not in building also?

Note.—By the mode above recommended, the pure salt contained in the water of salt springs, rock salt, &c. can, with the same facility, be obtained.

* The Dutch add a quantity of sour whey to their brine before evaporation.—^c The action of this substance *does not seem to be well understood*, though it is said to conduce to the production of large crystals.—See Notes on Muriat of Soda, in Thomeen's Fourcroy, vol. I: p. 497.

**Of Refining and Strengthening Common Salt
as presently made.**

Of all the schemes yet thought of, for refining the Common Salt, that of Lord Dundonald's is both ingenious and strictly chemical ; and it is therefore a little surprising that it is not practised universally.

In the Scots Magazine for October 1804, I find an excellent paper on salt ; but it is a little surprising that, to use the writer's words, 'Lord Dundonald's mode of purifying Scots salt, is founded on a presumption that English rock salt will be permitted to be brought and refined at the Scots salt works.' This is the more surprising, as his Lordship is made to say in that pamphlet, that the refining of a whole bushel will not cost *a penny halfpenny*. If this be the case, and since his Lordship's knowledge and authority will not be disputed, it is vain to attempt outdoing the noble Lord, whose plan should be instantly practised on Scots salt alone ; for surely the Legislature will not prevent us from purifying our own materials. But I suspect there is another cause operating against his Lordship's plan being rendered general, which led me to try the following experiment with the utmost care I was master of, agreeable to printed directions in my possession, and

which every one may easily get, and try the experiment himself.

I took of flour salt, as it is termed at the pans, (which is the best and dearest), one pound weight; one half of which I put into a conical vessel, having an aperture of only three-tenths of an inch at its apex, through which the boiling liquor made by a supersaturated solution of the remaining half pound of salt was to run; and I took care the liquor should be supersaturated: And to do the experiment all manner of justice, I poured the boiling liquor, as directed, through the dry salt in the vessel. I next made another supersaturated solution of part of what was in the vessel, with soft water; and did the same a third time; and finally examined, by caustic mineral alkali, the purity of the salt thus treated, with some left, not done in the same way; and certainly its purity was much improved, *though it still afforded a precipitate*. This salt, however, my printed directions instruct me, is *purer than any foreign salt*: hence it is purer than Dutch salt, used in curing of fish: and if there were no other objections to Lord Dundonald's plan, the object of the Society would thus be instantly accomplished. But it is sometimes difficult to reason accurately *a priori*; and therefore I was much surprised to find but a very small proportion of the salt thus rectified in the vessel, and almost wholly run off among the lees. Had the salt operated upon been very impure, the abundance of lees, which

ought to have been sulphat of magnesia, lime, &c. might have been accounted for: But a very considerable quantity of real salt could be collected, at the end of every operation, floating on the drippings in crystals, perfectly agreeing, by trial and appearance, to those of muriat of soda.— Thus we see, that although the theory be excellent, the practice (at least in the large way, where time and money are synonymous), would be abortive, by the running away of the very salt meant to be purified: And it surely cannot be said that three-tenths of an inch was too wide for the purpose; for if the bottom of the vessel had been perforated with gimlet holes, a boiling fluid would have been as little retained. And this, I presume, explains how Lord Dundonald's plan is not practised universally.

From the fact just mentioned, we plainly see, that this refined salt, which is said to be *purer than the foreign*, is still impure, * and rectified at a prodigious waste of the material: And therefore I am warranted in what I said (p. 416), that since, with the expense of 3s. 1½d. of kelp for every bushel of pure salt made by the mode recommended in this Essay, we have got to the *ne plus ultra* of purity; yet as the Dutch salt is far from this degree, we have it always in our power

* Otherwise there would have been no precipitate with an alkali.

to lessen the dose of the composition (p. 410); and thus bring the salt to be refined, not only to the purity of the Dutch or any other, but to surpass the whole; and, in this way, our scale may be varied at will, as to the expense.

To conclude—If the method of making pure salt, *direct from sea water*, upon the plan I have suggested, could be profitably and conveniently executed, it would be still more practicable in refining the *common salt* of any country. For this purpose, take any quantity of common salt, and make a saturated solution of it, in clear river water, or soft water; present either of the compositions to it, already mentioned, (p. 410); and proceed in every respect as described in the making of salt from sea water. It is also of some importance to mention, that the recovery of the contaminating heterogeneous materials is, in this case, more simple, than when the salt is prepared from sea water direct, as in the preceding Essay, (p. 370.)

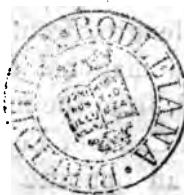
COMMON SALT.

40

BUILDINGS.

The buildings and vessels necessary, which would answer for both or either modes, viz. the taking of salt from sea water direct, or purifying the common salt as presently made, (upon the plan recommended), would be one salt pan of the common dimensions, perhaps six or nine inches deeper, and one vessel lined with sheet lead, of the same capacity as the pan itself. Or if the work was to be carried on extensively, two such pans, or more, with each its leaden vessel, would be required. A moderate supply of soft rater would be convenient.

Vote.—By the mode above recommended, the refining of the salt obtained from the water of salt springs, rock salt, &c. may be executed with the same facility.



AN ACCOUNT

OF THAT

DISTRICT OF WIGTONSHIRE CALLED THE RHINNS AND
MACHERS: DRAWN UP FOR THE INFORMATION OF
THE HIGHLAND SOCIETY OF SCOTLAND,
IN 1812.

By the Rev. Wm. DONALDSON, Minister of Ballantrae.

Felix qui potuit rerum cognoscere causas. — LUCRETIUS.

THE shire of Wigton, or Western Division of Galloway, is bounded by the water of Cree, and the moorish parts of the parishes of Colmonell and Ballantrae, on the east and north; and by the bays of Wigton and Luce, the Irish channel, and the bay of Lóchryan, on the south and west. In length, from Newton-Stewart to Portpatrick, in a diagonal direction, it is about 32 miles; and, from the march burn, about a mile north of the Cairn of Lochryan, to the Mull of Galloway, in an opposite direction, the distance is nearly

the same. It is deeply indented by two large inlets or bays of the sea, viz. By Lochryan on the north, which reaches nearly 12 miles inland, from its mouth to the town of Stranraer; and by the bay of Luce, which is of greater extent, both in length and breadth, entering from the Irish channel on the south, and advancing to within a little distance of the village of Luce.

These two bays are separated from each other by a flat isthmus of about 8 miles in length, by $\frac{1}{4}$, at an average, in breadth. According to the common understanding, all that part of the country which lies to the south and west of the water of Luce, is called the *Rhinns*; though, strictly speaking, the Rhinns comprehends only that long stripe within the isthmus, extending from the Mull of Galloway on the south, to the point of Corsall on the north, a distance of upwards of 80 miles in length, and, at an average, $\frac{1}{4}$ miles in breadth; comprehending the parishes of Kirkmaiden, Stoneykirk, Portpatrick, Leswalt, Kirkcum, and the town of Stranraer, which last is upon the very verge of the peninsula. On the other hand, all to the north and east of the water of Luce is denominated the *Machers*; but, in strict propriety, the Machers (which in the original language means a low lying fertile country) consists of that part of the county which lies to the south of the great military road betwixt Newton-Stewart and Glenluce; comprehending the parishes of Whithorn, Sorbie, Glasserton,

Kirkinner, Wigton, Mochrum, and the low part of the parishes of Penningham and Kirkcowan, and perhaps a part of the parish of Old Luce. The remainder of this eastern division may be characterized as moors, though intersected with very considerable tracts of arable land. These comprehend the upper parts of Penningham, Kirkcowan, and Old Luce, the whole of the parish of New Luce, and the moorish part of the parish of Inch. The isthmus consists of the low part of the parish of Old Luce, to the south of the water of Luce; of all the flat part of the parish of Inch, and a small part of the parish of Stoneykirk.

The county is thus naturally divided into four separate, distinct parts, exceedingly different from each other in soil and quality, as well as in situation. Though the Society only require an account of the Machers and the Rhinns, yet it will be requisite to take some notice of the other parts, so as their mutual connexion, and their dependence upon one another, may be more clearly understood, and correct ideas entertained respecting the great importance of attending to the improvement of a county naturally calculated to assume a prominent station in the scale of Scottish husbandry.

Before proceeding to a more minute detail, it may be observed, in general, that this county, though of no great extent compared with some others, contributes more to the wealth and support of the nation, than many of far greater ex-

tent. The great staple commodities, or produce of the country, are corn and cattle; and, from its peculiar maritime situation, these are capable of being brought to the highest state of perfection, and turned to the best advantage. It is not possible to conceive any county more favourably situated for water carriage. There are roadsteads, harbours, and landing-places, almost in every quarter, and at the most trifling distance from every part of the district. Exportation and importation may here be carried on with more facility, and at less expense, than in almost any other part of the island.

The bay of Lochryan is capable of containing a very large fleet in perfect safety; and all round the bay, coasting vessels can ground upon a smooth beach, for loading or unloading their cargoes; and no part of the country is more distant from the shore than two miles, and a great deal of it not near so much. At Portpatrick, on the western side of the Rhinns, there is an excellent key built at the expense of government. At Portnessock, on the same side, towards the Mull of Galloway, there is another small key; and opposite to it, at Drumore, on the shore of the bay of Luce, a good harbour has lately been built. All round this bay, the roadsteads, harbours, and landing-places, are numerous and good. There are the harbours of Portwilliam, Whithorn, Garlieston, and Wigton; and vessels can sail up the Cree to within two miles of Newton-Stewart, and

also up to the head of the bay of Luce, to within a small distance of the village. Lime is landed there, and at the mouth of Pultaunton-burn, which supplies all the low land in its neighbourhood, as well as the whole parishes of Old and New Luce, and the higher parts of the parish of Inch, to the distance of nearly ten miles from the sea.

These local advantages are considerably enhanced by the number of banking houses and customhouses established within the district; there being five branches of banks, and three customhouses. Of the latter, one is established at Wigton, another at Stranraer, and a third at Portpatrick, all separate and independent of each other. The mail-coach betwixt Dumfries and Portpatrick passes through the county every day, which of itself is a great advantage. The banks and customhouses are of great consequence in facilitating communication, and expediting business; and the latter are so judiciously situated, as to admit of a ready intercourse with England, Ireland, the Clyde, and other western parts of Scotland, to which places exportations are made, and importations of lime, coals, timber, iron, and every other article that either the taste or necessities of the county require. When taking this general outline of the county, it also merits observation, that these numerous inlets and bays, and general contiguity of the whole district to the sea, must add considerably to the salubrity

and beauty of the district. So that, including all these advantages, the inhabitants of this district may truly say, what a great man once, in substance, said; ‘ The lines have fallen unto us in pleasant places ; yea, we have a goodly heritage.’ That the Society may have a more distinct view of the advantages which appertain to Wigtonshire, it is necessary to go a little more into detail.

The Rhinns is considerably elevated above the level of the sea, and extends in a kind of rounded ridge from one extremity to the other ; thereby defending it from the storms and ravages of the Irish Channel. The whole division is arable, with the exception of part of the parish of Portpatrick, which is mountainous, wet, and mossy. The soil of the northern part of the peninsula, and in several places of the back shore, (as it is termed) along the Irish channel, is of a clay nature, upon a retentive subsoil. The remainder is of the nature of loam, upon an absorbent subsoil. Part of it, immediately contiguous to Lochryan, and the bay of Luce, towards the Mull, is of a light, gravelly, and sandy nature.

On the estate of Kirkcum, belonging to the Earl of Galloway, considerable tracts of shells and shell marl are to be found ; and the whole district having ready and convenient access to lime, which has every where been liberally applied, cultivation has advanced rapidly within the last 20 or 25 years. Immense quantities of

grain are raised; and many fine cattle are reared or fed for the English markets. Good farming is beginning to be understood, and even to be practised, by the middling classes. Mr William Ross, collector of the customs at Stranraer, who rented a considerable farm on the estate of Garthland, led the way to the introduction of modern husbandry; and he has been followed by the Ralstons and Cochrans from Ayrshire, by Mr David Shank, Mr Alexander McDowall at Curgie, Mr M'Clerie at Mountpleasant, and others in the district, where farming is generally conducted in a style that would bear comparison with many of the best improved Scottish districts. A farming Society has for some time been established in the Rhinns, which may have contributed to promote this, by their conversation, their premiums, and their liberal communications of knowledge and practice to each other. But what, above all other circumstances, has served to make improvement spread with rapidity, is the spirit of the times, the progress of society, the increase of rent, and the increased value of farm produce. These circumstances combined, have created a stimulus which it is to be hoped will exert itself till the district is brought to a higher state of cultivation than it has yet attained. Some wheat and barley, and bear or big, are raised. Turnips and potatoes, to a considerable extent, are planted in drills; but oats are the chief staple of the district, and to which the climate is most adapt-

ed. Every person that pretends in any degree to farming, practises a regular rotation of cropping; and this has chiefly taken place since the introduction of the dairy and turnip husbandry.

The isthmus which lies betwixt the bays of Luce and Lochryan, and connects the former division with the other parts of the county, is of a very different quality from what is mentioned above. It is a flat of about 32 square miles, a good deal of which is flow-moss above a bed of sand, and, where it is dry, sand and gravel are the prevailing soil; the whole exhibiting a high degree of probability of its having, in remote ages, been covered by the sea. The estate of Genoch, which is situated at the south-east extremity of the isthmus, forms a striking contrast to this general character. It is for the most part a strong clay loam, covered in some parts with a thin stratum of moss-earth, which, when pared, burned, and mixed with the subsoil, and properly cultivated, produces the most luxuriant crops of every kind of grain as well as grass. John Cathcart Esq. of Genoch, who is one of the most intelligent, judicious, practical agriculturists of the present day, occupies about 600 acres of his own estate, of which this rich land forms the principal part; and he conducts his farming operations according to the most approved modes of modern husbandry. Naturally barren, however, as this part appears, it was here that any thing like improvement was first introduced. The great

Marshal Stair, about 80 years ago, enclosed a considerable portion of his estate in the low part of the parish of Inch; planned and executed the beautiful scenery of Castlekennedy; and built the barracks of Culhorn for accommodating his regiment of dragoons, while they remained in the county, which is the only residence of the family to this day. His heir and successor, the late Earl of Stair, between 40 and 50 years ago, began cultivating these dry barren fields, great part of which, in their natural state, were covered with short sapless heather. After completing his enclosures, and forming extensive belts of planting for shelter, he had the ground thoroughly pulverized by repeated ploughings; and after being sufficiently limed, he took a crop of turnip broadcast, and sowed down the fields with oats and grass-seeds for permanent pasture. Even with this mode of culture, fields which, in their natural state, were scarce worth sixpence an acre, discover considerable verdure to this day.

The greatest part of this tract, by draining the mosses, liming and manuring the whole, and cultivating green crops, might be brought, under proper cultivation, to produce good pasture, but can never be adapted for a regular routine of cropping.

Along the skirts of the hills, from the Cairn round to Glenluce, there is a stripe of light, kindly mould, peculiarly adapted to the turnip husbandry; and upon the slopes, and even the tops

of the hills enclosing the isthmus on the north, the pastures are excellent, bullocks of the largest size, and fit for the English market, being there fed in perfection ; and on some of them (such as the farm of Beoch) they are kept in the field during the whole year, without any other feeding than what they gather off the ground. In proof of this, it may be recorded as a singular curiosity, that it was upon this farm Marshal Stair gave Chelsea to his old favourite horse which he rode at the battle of Dettingen; and so well did the old charger agree with his quarters, that, at the age of 34 or 35, becoming plump and hearty, and one day frisking and galloping about, he fell over on his back in one of the hollows, from which he could not recover himself, and so finished his military career.

In the parts of the country above mentioned, the dairy husbandry has been set up by strangers coming from Ayrshire, and has since been followed by some of the native inhabitants. This, no doubt, is an unequivocal symptom of the increased cultivation of the county; and, by the increase of manure, and of green crops which it occasions, may lead to its farther improvement. The superior profits which this system affords, may lead to its continuance and increase ; but how far these circumstances may interfere with the favourite employment of rearing and feeding the finest cattle, and whether the blood of the native breed (confessedly a most valuable one) may not be gradu-

ally contaminated by the dairy cows introduced from other counties, are questions that will deserve the most serious consideration.

The true Ayrshire breed of milk cattle is beautiful, and excellent of its kind. Every way well-proportioned, they fatten well; and the flesh is as well flavoured as any other. Besides, this breed, when well fed from the beginning, will grow to a very great size. Mr Cathcart of Glennoch, last summer, had two two-year old bullocks, of his own rearing from the Ayrshire breed, pasturing on his farm, which he offered to Mr MacDowall of Logan to stake against any two cattle of the Galloway breed that could be produced. Still, however, the Ayrshire cattle are rejected by drovers and English dealers; but whether from an opinion of their want of hardiness, and ability to endure fatigue, or from mere prejudice, it is difficult to determine.

Much speculation and much discussion has taken place since the introduction of the Dairy system into the Rhinns, how far it may contribute to maintain the character, and promote the ultimate benefit of the district. Without entering deeply into this question, it may be observed, that what supports the character of Galloway, and has long contributed to its wealth, is its fine breed of cattle. Now, if the Ayrshire breed of cattle, however excellent in their kind, but which are abominated by the Scotch and English drovers, should mix with the native Galloways, they

might contaminate the breed of the county, and ultimately produce * incalculable mischief. It may be observed, farther, that every separate district has its own peculiar manufacture, employment, and mode of management, with which, from long habit, it is best acquainted, and by which it has prospered. The Lothians have been long celebrated for the best modes of farm culture ; Clydesdale for rearing the best kind of farm horses ; Ayrshire for making excellent cheeses ; and other parts of Britain are equally distinguished for their peculiar manufactures. Galloway has also been celebrated over all Britain for its excellent breed of cattle, and for raising the greatest quantities of oats. The management of cattle has long constituted the favourite employment of the inhabitants ; and, under it, they are thriving and prosperous. If we reason from experience, therefore, it would seem most wise and prudent for Gallovidian farmers

* From what is here said, it might be inferred, that the breeding of domestic animals in Wigtonshire was left to the chapter of accidents ; and that no selection of the individual males or females was made. To those, however, who know the particular attention and care bestowed on their choice, no risk of what the author here dreads will appear. Both breeds are excellent of their sorts ; the Galloways as feeding, and the Ayrshire as dairy stock. There is no necessity nor propriety in mingling or crossing the breeds of two distinct varieties of black cattle, more than of horses.

to confine themselves to the rural system by which their character is suspended, and from which their prosperity is derived ; and to endeavour, by every means in their power, to bring the branches of business in which they are engaged to the highest state of perfection. For, excellent as their cattle are, it is surely possible to make them better. With regard to farm culture, however, much has recently been done ; yet, when compared with other districts, it must be acknowledged that there is great scope for future progress. As a general remark, it may be urged, that it is a † dangerous thing suddenly to overturn long established habits, or alter the train of customary ideas, without some imperious necessity, or until evident practical utility shall sanction the experiment.

The other division of Wigtonshire, which is situated to the east and south of the water of Luce, is by far the largest, as well as the richest ; and comprehends within its bounds the district called the Machers, which includes that part of the county which lies to the south of the great road leading betwixt Glenluce and Newton-Stewart ; though, were the etymology of the name attended to, its limits would not be so extensive. The remainder is moor and moun-

† And yet, without ‘ overturning established habits, and
‘ altering the train of customary ideas,’ however great the
scope for future progress may be, no progress can be made

tainous, though interspersed with considerable tracts of valuable arable land along the sides and banks of streams and rivers, and around farm-houses. The shores round this part are, in general, bold and rocky ; and the land rises with a very gentle acclivity from the bay of Wigton to the tops of the mountains which divide the district from Ayrshire.

The whole of the Machers, with very few exceptions, is arable ; and, taken altogether, it may be considered as a rich and valuable tract of country. The soil is generally of the kind called hazel mould, upon a bed of that species of rock called schistus ; with pieces of gravelly soil here and there interspersed. That part of it which is immediately contiguous to the bay of Wigton, comprehending the greatest part of the estate of Baldoon, to the extent of several thousand acres, is strong alluvial or carse land. And along the valley of Cree, to within a little distance of Newton-Stewart, the soil is a deep strong clay, intermixed with extensive pieces of moss. The external surface of what is properly called the Machers, presents a very peculiar appearance, rarely to be met with, except in some parts of the neighbouring stewartry of Kirkcudbright. The ground is generally studded with knolls and rocky protuberances, as if they had been placed there by art or design ; and it is in the very best lands of the district where these most prevail. An obstruction to tillage is no doubt thereby presented;

but, in other respects, these knolls are of great advantage, by the shelter they afford against the storm, and the fertility which they occasion. They are like natural sheds in an open field.

In this part of the country, from possessing great quantities of marl, and having ready access to shells, cultivation began as early as in most places. But farmers, at that time, having very little agricultural knowledge, and knowing nothing about the rotation of crops, especially of leguminous ones, their concern was confined to reap the fruits of their expense and labour, by taking as many white crops in succession as the ground could produce, and then leaving it to nature to renovate itself in the best manner it could; in which way the ground was frequently left in a state worse than it was when their operations commenced. There is some reason to apprehend, that the effects of this mismanagement are in many instances felt at the present day, as may be discerned in several parts of the district first brought under cultivation, and where marl had been most liberally applied. But, since better modes of farming have been introduced, the Marchers of Galloway have kept pace with any part of Scotland in similar circumstances. Nor is it any exaggeration to say, that the cultivation practised by several farmers might vie with some parts of the Lothians themselves; though this cannot by any means be stated as applicable to the general husbandry of the district. Improve-

ments in agriculture, like those in every other art, need only a beginning; and when their advantages are discerned, individual interest stimulates and accelerates the process. They may be compared to the motion of a stone from the top of an eminence, which is slow at first, but increases in rapidity as it descends to the bottom. Knowledge is daily acquired; an interest and attention are thereby excited, and a few successful examples of industrious, intelligent, and spirited farmers, promote emulation among others to follow their steps, and to imitate their practice. This is the natural progress of improvement everywhere; and we have no reason to doubt that it will be the case here, considering the attention that is bestowed upon the subject by the respectable proprietors of the district, whose conduct is excelled by none, and hardly equalled by the landed proprietors of any other Scottish district.

Indeed, throughout the whole shire, the attention of proprietors to promote agricultural improvement has for many years been recognized. The late Earl of Stair, Mr M'Dowall of Logan, the honourable Captain Maitland, Sir John Hay, and the present Mr Cathcart of Genoch in the Rhinns; the late Earl of Galloway, and his brother Admiral Stewart; Messrs Stewart of Physgill and Tonderghie, Mr Hathorn of Castlewig, Mr Boyd of Mertonhall, and others in the Machers, were all real practical farmers. They di-

rected and superintended their farm operations ; bought and sold their own cattle, without trusting entirely to salesmen and overseers ; and, by this spirited, judicious, and successful example, they showed to their tenants what could be accomplished by the same means. And the effect every where was like electricity in stimulating to exertion and activity. The late Earl of Gallo-way, in particular, by granting leases upon a great part of his extensive domains, of 21 years, and the life of the tenant, did more to promote immediate cultivation than can well be conceived, in such a short time. Under these circumstances the tenantry, trusting to the duration of life, naturally entered keenly upon a business which they were to enjoy the fruits of as long as they lived. And the general improvement of his Lordship's estate, particularly of the barony of Corsall, in the Rhinns, shows that he calculated right. For that estate, which, when let by his Lordship nearly 20 years ago, did not produce much above 1000*l.*, would yield, it is believed, if let just now, at least seven times * that sum.

The attention of farmers being almost equally divided betwixt tillage and grazing, it is difficult

* The utility of leases, no man who knows the human character can doubt ; at the same time, there are other causes to which the increased value of lands must be attributed, besides improvement, viz. the increased *nominal* price of produce. Where rent is paid in kind, no such rise as is here stated has taken place.

to say which of these two engrosses most of their attention. Grazing occupies almost entirely the attention of some, while there are scarce any who do not either breed or rear a few cattle. Indeed, the attention of all ranks is so enthusiastically directed to cattle, that they are the constant subject of their thoughts, of their conversation, of their boast and emulation ; and there are few or none who are not perfect connoisseurs about them. Not only professed dealers, but gentlemen farmers, nay, even herds, hinds, and cotters, can tell the properties and defects of a bullock, and guess very nearly as to his weight, and to his price, according to the state of the market.

These cattle are what are called the Galloways, so much celebrated all over Scotland. They are so well known, and have been so often described, that any minute account of the breed seems to be unnecessary. They are generally polled ; of a black or brownish colour; well haired; round and straight in the body; well quartered; every way well proportioned ; and, when fully made up, they are most beautiful animals. Their general properties are hardiness, and aptitude to grow and fatten. Their flesh is finely marbled and well flavoured ; and preferred in the Smithfield market to † any other. These

† The reverend author has here made a small mistake. The west Highland cattle sell still higher, weight for weight ;

cattle, when at $3\frac{1}{2}$ and $4\frac{1}{2}$ years old, weigh from 40 to 60 English stones, and have been known of late years to sell from 18*l.* to 20*l.* a head. This is about the average price of what are sent to England. Sometimes, for a boast, a few of the best are picked out of a lot, and kept a year longer : These are known to have sold as high as 30 guineas a head ; but they become so large and so fat, that they are unfit to travel to the English markets, and are sold to the shambles in Scotland.

The benefit which the country at large derives from the husbandry of this district, will be apparent, when it is considered, that, small as it is, at least 3000 of these cattle are sent annually out of the county, to supply the wants of our southern neighbours. The whole of that number are not of the age, size, and price above mentioned ; these being only such as are sent to St Faith's, Hampton, and other English markets. Nor are they all reared or bred in the Machers ; some being brought from the moors, some from the Rhinns, and some from the head of Ayrshire and prepared for sale in the fine rich pastures of the Machers.

Besides the cattle sent to England, a considerable number of cows are fed annually, or sold if

and are certainly, on the whole, still more beautiful and gant animals than the Galloways, and probably the droving cattle in this kingdom, or perhaps any other c

which serve to supply the internal consumpt of the county, or the towns and villages of Ayrshire, and the West of Scotland. Some idea may be formed of the extent of this consumpt, by reflecting on the number of towns and villages that are to be supplied. Stranraer alone is known to require annually upwards of 400 beeves, besides other butcher's meat; and, besides this, there are the towns of Wigton and Whithorn, the villages of Newtonstewart, Garlieston, Glenluce, and Portpatrick; and the shipping upon the coast. In addition to this demand, there are a number of dealers constantly employed through the whole season, in driving both sheep and cattle, fat and lean, into Ayrshire, and the Stewartry of Kirkcudbright.

As it is chiefly of the Machers and the Rhinns the Society wish to have an account, any description of the moor part of the county may be very brief. Agriculture has made some progress here of late years, as well as everywhere else, wherever the soil is adapted for it; in particular, up the river Cree above Newton-Stewart, up the Bladnoch, and up the main and cross water of Luce; to which last places lime has been driven nearly ten miles from the sea; and good crops, both of oats and sown grass, are produced. But the chief employment of all this tract is breeding and rearing sheep and black cattle,

The sheep are all of the true Scots, or black-faced kind; and are sold, when two or three

years old, over all the west of Scotland. The cattle are bought up at one, one and a half, and two years old, by the graziers in the Machars, by dealers from Ayrshire and the Stewartry of Kirkcudbright; and many are sent to Dumfries-shire, where they are kept, and the north of England, until they are fit for the south. It is in this way that the moor part becomes connected with the Machars, and that each part is of mutual benefit to the other.

It deserves to be mentioned, for the information of the Society, that in the parish of Mochrum, and also lately on the shores of the estate of Genoch, at the head of the bay of Luce, there is a breed of small white, or dun-faced sheep, remarkable for the fineness of their wool. It is taken notice of by Dr Anderson, that this is one of the two places in Scotland (* Shetland is the other) where are to be found the remains of the sheep, that were remarkable, in antient times,

* With all submission to the reverend gentleman's better information, it may safely be asserted, that the breed of sheep here mentioned is no other than the variety *Ovis Cauda Brevi*, the short-tailed sheep of the interior Highlands of Scotland, of the Hebrides, of Orkney, of Zetland, and almost the only sheep of Norway, Sweden, and Iceland, at this day. How, under these circumstances, the wool of this breed was so very precious, seems somewhat paradoxical. Let the reverend gentleman try the woolstapler with a few packs of this wool, and he will, perhaps, find it the most unsaleable of that of any other breed.

all over Britain, for the fineness of their wool. And so precious, he says, was this British wool esteemed, that it required the interposition of an ambassador to procure a parcel of it for a foreign potentate.

Tillage, as well as grazing, is carried on with great spirit, both in the Rhinns and Machers; and rapid advances to good husbandry are making in both districts. Nature, or in other words, climate and situation, seem to point out oats as the staple crop; and accordingly, it forms the chief article of grain that is exported. In former times, bear or big was one of the species of grain upon which farmers, in a great measure, depended for the payment of rent; and, to produce the greater quantity, the whole dung of the farm was always laid upon the same spot, for the bear crop, from generation to generation. At that period, under the management then exercised, there was an annual struggle betwixt the weeds, the wild oats, and the bear, for superiority. But these fields, under modern husbandry, produce the best crops of grain, and furnish the finest and richest pastures in the county. Bear and barley are still raised, though not in such quantities, since the last additional tax on malt. They are sometimes manufactured into hulled or pot barley, for exportation. Of late, considerable quantities of wheat have been raised; and the cultivation of this grain seems to be upon the increase.

There can be no doubt that many parts of the

district are well adapted for wheat ; but perhaps it might be prudent to desist from cultivating that grain on an extensive scale, and to take chiefly such grain crops as are more congenial to the climate. The district being so much indented by arms of the sea, is much exposed to moisture ; therefore the climate is more propitious for oats than wheat, being mild, moist, and warm ; whereas wheat requires a dry climate to bring it to perfection. Hence foreign wheat is vastly superior* to any that is raised in the most favoured parts of Scotland. In Egypt, Sicily, along the coasts of the Mediterranean, and in the south of France and Italy, where the heat is great, and a drop of rain scarce ever falls through the summer months, there is the best wheat in the world. The misfortune is, that in Wigtonshire the rains are commonly heavy, at a time when the wheat runs the greatest risk, by being in the flower.

Potatoes, of which vast quantities are now raised, have of late, both in the Rhinns and Machars, most injudiciously become an article of exportation. In a part of the country where manure can no otherwise be supplied than from the produce of the farm, it is of infinitely more advantage to feed stock with it, than export it, for

* This may be true as to the wheat of some countries, but not so as to that of others. Though we cannot raise the best wheat in all the world, it is no reason we should raise none.

all the trifling profit that it brings ; and in this point of view, turnips, an acre of which will feed as many bestial as two of potatoes, seem to be the preferable article. Green food during winter, is of the utmost consequence in every district where live-stock are reared, particularly for young cattle ; as, without it, they are stunted in growth at the outset, and never get that bone, or arrive at that size, which they are capable of attaining, if duly supplied with succulent food. Besides, such food contributes exceedingly to the health and future growth of live-stock, which much more than indemnifies the tenant for the trouble and expense of their culture. In short, every lease ought to contain a clause, prohibiting potatoes, or any kind of green food, from being carried off a farm, unless it be situated in the neighbourhood of some town or village where dung can be purchased in such quantities as may serve to compensate the exhaustion of the soil by the removal of the green crop. The removal of fodder is prohibited by common law, unless it is allowed by special agreement, or in situations where dung can readily be procured. Now it is of fully more importance to extend the law, whether legal or conventional, to green crops, which contribute in a greater degree to the improvement of husbandry.

The amount of the exportation of the various kinds of crop of 1811, (though rather a deficient one,) as ascertained by the books of the Customhouses of Wigton and Stranraer, was as under.

	Wheat. Qrs. Wt.	Bailey. Qrs. Wt.	Bulled Barley. Qrs. Wt.	Bear. Qrs. Wt.	Oats. Qrs. Wt.	Oatmeal Balls of 8 stone. Qrs. Wt.	Peas. Qrs. Wt.	Beans. Qrs. Wt.	Rye. Qrs. Wt.	Malt. Qrs. Wt.	
Wigton,	6,524	6	5,933	4	21	28	10	0	37,467	4	—
Stranraer,	888	6	1,476	1	7	56	—	19,898	2	9,003	—
Total,	7,413	4	7,409	5	28	84	10	0	57,365	6	9,003

The quantity exported from Portpatrick being but small, was not enquired for. When the sales of the sheep and cattle, above mentioned, are added, it will appear how greatly this small county contributes to the national support, and of what weight it is in the national scale. Corn and cattle, as said before, are its great staples; and without corn and cattle the nation cannot subsist.

The district is without valuable minerals ; there being neither coal nor limestone, lead nor iron ore, of which any discovery has yet been made. Two trials were made in the Rhinns for coals, which were not successful. The one was made by the late Earl of Stair, and the other by Mr Vans Agnew, in the immediate neighbourhood of Stranraer. There are rocks in abundance ; but the writer of this paper not being a mineralogist, cannot speak scientifically about them. Only, in general, it may be asserted, that so far as his information goes, these rocks have never been applied to any other purpose than building houses and stone dykes. In the parish of Leswalt, in the neighbourhood of Stranraer, there is a kind of coarse reddish freestone ; but the freestone used for building in that town and neighbourhood, is mostly brought by sea from Saltcoats and other places. Slates are found in different places. There is a slate of a good quality, that has been long wrought in a quarry upon Mrs Dunlop's estate of Cairn, upon the shore of Lochryan ; though not to the extent that it might be. Another has been opened in the neighbourhood of Newton-Stewart : And towards the Mull of Galloway, upon the lands of Logan, another has been opened for more than 20 years ; but the slates are not of a good quality. The stones are intermixed with veins of iron ore, in all directions, which renders the slates friable, when exposed to frost and winter storms.

There are no manufactures of consequence within the district. A cotton mill was erected at Newton-Stewart, a good many years ago, by the late David Dale and Sir William Douglas; but it did not succeed. They afterwards sold the mill and machinery at less than half of the original price. Woollen mills have also been attempted upon a small scale; but these have also failed. In the woollen manufactory, in particular, though skill, capital, situation, and every thing else, were complete, yet, unless it be carried on, as in England, by the division of labour, from the wool stapler to the lapper of cloth, it will never succeed. Indeed, in such a county as Galloway, it is extremely problematical how far it would be prudent to attempt manufactures of any sort. The thinness of the population could not supply hands for carrying them on. The total want of coal, and scarcity of wood, are invincible bars in the way of such establishments. And, what is more than equal to all these put together, the distance from marts and great manufacturing towns; the risk and uncertainty of carriage; the expense of insurance, of agents and correspondence, would render it next to madness to attempt manufactures. All these things united, render it extremely probable, that the shire of Wigton will never (at least for many years) become a manufacturing country. The business in which the inhabitants are engaged is congenial to their habits. It occupies all the hands they can procure.

Their produce is disposed of without any risk; and at almost no trouble or expense: Drovers and corn-dealers come to their houses and purchase their corn and cattle. All their trouble is, to deliver their corn at the shore, and their cattle at the park-gate in which they feed; while the risk of transportation of both the one and the other lies with the purchaser. The concern of the seller is to obtain proper security for the price; and, if he fails in that respect, he has none to blame but himself.—For a good while past, a tan-work has been set up at Newton-Stewart, on a moderate scale. At this place, also, there is a small brewery, and another at Stranraer, which are of great use in consuming part of the bear that is raised; and also for furnishing a wholesome beverage of good ale, which is infinitely more healthful and salutary than whisky, of which too much is unfortunately imported and consumed, to the great danger of both the health and morals of the lower orders of society.

One of the greatest defects of the district is, the want of a sufficiency of wood for use and ornament. There are some few copse woods, and several fine plantations round Galloway-house; and a very few round other gentlemens' houses and pleasure grounds, in the lower part of the Machers; and at Park, Balkail, Culhorn, Castle-kennedy, and Garthland, in the Rhinns. This year Mr M'Dowall of Logan has planted, on his estate in the Rhinns, to the extent of 40 or 50

acres. Still, however, with all these, the country wants the rich and picturesque appearance which arises from spreading hedges, hedge-rows, belts, and clumps of planting. The proprietors of the district are every where beginning to be so sensible of this, that they are multiplying their plantations as fast as the nature and situation of their several properties will admit.

But if the district be deficient in this respect, it has advantages which far more than counterbalance it.—In the first place, the district being situated at the very southmost point of Scotland, and in no part at any great distance from the sea, the climate is mild and salubrious. The crops are accordingly earlier than in most other districts in Scotland, and generally are got safely preserved. Seldom or never is the ground incumbered with frost or snow to such a degree, as, for any length of time, to interrupt the labours of the field. The climate, it is true, may be considered as too moist; but this, instead of being any inconvenience, may be looked upon as an advantage, in so far as it serves to preserve almost a constant verdure upon the pasture, both in winter and summer, and to promote the growth of oats, which agree with moisture, and are, or ought to be, the staple of the county.

In the next place, by far the greatest advantage which Wigtonshire possesses, arises from its contiguity to the sea. No county can be more favourably situated than this is for maritime

transactions and correspondence. While their cattle are driven to England by land, they hold a communication with it by sea, from the bays of Wigton and of Luce, as far as the Mull of Galloway. To Liverpool, Whitehaven, Workington, &c. they send grain and other farm produce; and from thence are imported lime, coals, timber, iron, wine, sugar, and every other article, that either the necessities, the taste, or the luxury of a country, can demand. At Garlieston, on the Bay of Wigton, in particular, there are a number of vessels employed, during the proper season, in that trade.

From Lochryan a communication is kept up with the Clyde, Ayrshire, the Highlands, Ireland, England, the Baltic, and America. From Ireland immense quantities of lime are imported, both for the land, and for building. To the Clyde, and sometimes to Ayr and Irvine, the export of grain is carried on; and from Irvine and Saltcoats coals and freestone are imported for supplying the town of Stranraer and neighbourhood. There is a regular established packet betwixt that town and the Clyde, for the conveyance of spirits and bulky merchandise. By means of this conveyance, there have been sent, of late years, to the Glasgow market, to the amount of at least 3000 stones of sweet-milch cheeses—a trade that seems to be annually increasing. The people of Stranraer embark in the herring fishery,

which turns out frequently but a precarious business. They are also employed in the more lucrative trade of timber and iron with America and the Baltic, when they are not prevented by the ravages of war. There is a small oyster fishery carried on from Lochryan of late years. They are caught with drag-nets, and sent, in shell, in small boats, to the Clyde and Ayrshire. Many poor people gain a livelihood by pickling oysters, and packing them up in small barrels, which, from long habit, they do to great perfection.—A harbour has been projected at Stranraer, and is much wished for by the merchants and traders of that town. It might be formed at not a very great expense ; and certainly it would tend much to the future prosperity and improvement, not only of that town, but of the adjacent country. If the Earl of Stair, and the other conterminous proprietors, were to join the town of Stranraer in the formation of such a harbour, important results might accrue to the agricultural as well as the mercantile interests of that part of the district.

From Portpatrick some small exportations of grain, and importations of coals, and a few merchant goods, take place. But the importance of this place consists in its being the great thoroughfare betwixt Ireland and Britain. Here a key was built by Government about 40 years ago, at the expense of about 20,000*l.* Upon the ferry betwixt this and Donaghadee, there are four packet-boats established by Government for com-

veying the mails, which pass and repass regularly every day, when the weather answers. Considering the tremendous rocky entrances at both of these places, it is astonishing how few accidents happen. Besides the packets on this ferry, there are a great number of other vessels employed for the transport of cattle and horses; as from 12 to 20,000 cattle, and from 2 to 3000 horses, are imported annually from Ireland at Portpatrick. The cattle are, for the most part, driven to England; and the horses are dispersed through the inland parts of Scotland, and the north of England. There is no business at Portpatrick, except what arises from this thoroughfare. But the great and constant influx of people passing to and from Ireland, and the emoluments arising from such an immense importation, must occasion a considerable circulation of money and consumpt of provisions, which will always add a little to the national stock, by creating so much productive labour.

As to the Fisheries, of which the Society requires an account, little need be said. Besides the oyster-fishery above mentioned, there is such plenty of fish of various kinds all round the coast, as sufficiently supplies the wants of the inhabitants, though the quantities are not such as to furnish a subject of exportation. In Lochryan and at Portnessock, considerable shoals of herrings sometimes appear; and seldom a year passes but some are caught, which are mostly con-

sumed in the county, and in the neighbouring county of Ayr, and the stewartry of Kirkcudbright. In the bays of Luce, Wigton, and Lochryan, and along the whole extent of the Rhinns, small sea-fish are taken in abundance; such as, codlings, haddocks, whiting, skait, &c. These supply an agreeable and nutritive dish at gentlemen's and farmers' tables, and are a great means of support to the lower classes who are within reach of the sea; but, on account of the smallness of their price, and the distance of conveyance to proper markets, they can scarce ever become a subject of trade or exportation. There are a good many salmon caught in the different rivers, from which branch of fishery the proprietors are believed to draw about 200*l.* of annual rent.

In speaking of the productions of Galloway, it may be mentioned for its singularity, that it is on the steep rocks at the Mull of Galloway, where the plant called Samphire is obtained; which is so much relished as a pickle by the connoisseurs in good eating, and desired by the ladies in order to set off the economy of their tables. But the risk and danger of collecting it here being little inferior to that at the cliffs of Dover, as described by Shakespeare in his tragedy of Lear, it is apprehended that its use will never extend far beyond the limits of the country in which it is produced.

With truth the county of Wigton may be cha-

racterized as an important maritime district; contributing most essentially, by its productions of corn and cattle, and by the extensive intercourse which it maintains with other counties of Scotland, with England, Ireland, and foreign parts, to the national wealth. It is a district in which agriculture has made considerable progress. The tenants are generally intelligent, industrious, active and sober. The proprietors are enlightened, spirited, and liberal ; and, from their mutually possessing these qualities, important results may be speedily expected. Draining, enclosing, planting, good farmsteads, together with the continuance of a liberal connexion between landlord and tenant, seem to be essential requisites for accomplishing this. To these things may be added, that, till such time as the husbandry of the country comes to something like a state of perfection, and indeed, in every state, the greatest benefit that the community in general, and the tenantry in particular, can receive, would arise from rendering leases a mercantile commodity, by granting power of assigning and subsetting, due care being always taken, in the original contract, to lay down such rules and regulations as might be necessary to guard the property of the landlord from waste or deterioration. Were these things duly attended to, it is utterly impossible that either assigning or subsetting could injure the interest of the proprietor in the slightest manner.

Until of late years, comparatively speaking, the shire of Wigton was almost insulated, from want of roads of communication, in consequence of the broken nature of the ground, and high mountains by which it was on all hands surrounded. About fifty years ago, there was not a road betwixt Dumfries and Portpatrick on which a carriage of any kind could travel with any degree of safety ; and the road into Ayrshire, at a much later period, was no better. About that time, a most substantial military road was made between Dumfries and Portpatrick, at the expense of Government ; and the conduct and oversight of it was committed to a Colonel Rixon, to whom ample powers were given, and in whose hands a sum of money was placed for defraying the expense. Either the business of a road engineer was not then understood, or this gentleman was influenced by whim and prejudice, or perverseness, in order to thwart the views of proprietors, through whose lands the road was to be carried. But from whatever cause it happened, so it was, that this great national improvement was frequently conducted in the most improper manner, without, in the slightest manner, regarding either ascents or descents. However improperly this road was at first conducted, it was the first thing that opened the eyes of the gentlemen of the county to the importance of good roads. About the year 1780 or 1781, they applied for, and obtained an act of Parliament, for converting the

statute labour into an assessment in money ; and after, by this means, making a number of public and parish roads through the district, they have latterly directed their attention to the roads of communication with other parts of the kingdom. The line between Newton-Stewart and Glenluce has been entirely altered ; and a most excellent level road, above 80 feet wide, has been made in its stead. Part of this road, between Glenluce and Stranraer, passing through a level country, required little attention in that respect ; but between Stranraer and Portpatrick it was as bad as possible, and as much so as the other parts of the road formerly were. Of late, the gentlemen have also changed the line entirely between these two places. By taking a circuitous direction to the south of Stranraer, and increasing the distance only two miles, a safe, commodious, and level road is obtained. But as the road through Stranraer is not in a straight line betwixt Glenluce and Portpatrick, making a considerable angle, since the alteration last mentioned was made, and increasing the distance several miles betwixt these two places, it has been projected to carry the road between Glenluce and Portpatrick in a straight line, through the two Genochs, part of the lands of Garthland, and those belonging to Lord Stair, and to join the present road through Stranraer, somewhere near the farm of Mount-pleasant. If this is accomplished, it will render the stage between Glenluce and Portpatrick al-

most a complete level, and shorten the distance by several miles.

The road from Wigtonshire into Ayrshire was as difficult as the other, if not more so. About thirty years ago an entire new road was made, partly at the expense of Government, and under the direction of a Government overseer, from the Cairn, through the parishes of Ballantrae and Colmonell, by the shore, to Girvan ; and numerous bridges at the same time were built, partly at the same expense. But here, again, the country was much disappointed, and the liberality of Government in a great degree frustrated ; as the overseer appointed was quite unequal to the task. He had no doubt a difficult country to pass through ; but a blind man could have conducted himself nearly as well as this gentleman did. Several alterations, however, have since been made upon it to the better ; but the line must yet be farther greatly altered in various places, before it can be rendered either a safe or commodious road of communication. By the knowledge now obtained of road-lining and road-making, by means of the theodolite and spirit-level, this line of road might easily be conducted through this difficult tract of country, in such a manner, as to render it both safe, pleasant and convenient.

About fifteen or twenty years ago, the gentlemen of Ayrshire and Galloway united to make a road of communication from Newton-Stewart to

Lyr, by Maybole, through Minnigaff and the ills of Barr, which has shortened the distance etwixt these two places nearly one half. This road is principally frequented by carriers and eople on horseback, as, owing to the high, moun-tinous country through which it passes, it is ot perfectly adapted for gentlemens' carriages. Though a most useful road, it requires a good lead and a stout heart to pass in a carriage along he verge of a precipice, where, if any accident were to happen, the traveller must inevitably be ashed to atoms.

Another road, much more safe and commodi-us, has been projected, planned, and is just now i execution, between Ayrshire and Newton-Stewart, and the other parts of the Machers, in an-ther direction. This road branches off from the ne betwixt Ayr and Portpatrick, at the house f Daljenock ; crosses the water of Stinchar at hat place ; is carried up the valley of Dusk, hrough an extensive tract of arable land, and a-cross the head of the parish of Peningham to Newton-Stewart. The country, it is believed, is biefly indebted for this line of road to the ac-ve exertions of James Ferguson of Crosshill, squire, advocate ; a gentleman who has done ore to promote the rural economy of the coun-y, and the interest of agriculture, than many ersons of the present day. When this road is ompleted, it will render the communication be-vixt the Machers and Ayrshire safe and com-

modious, and afford great facility for the improvement of the country through which it passes; which, at present, is in a state of nature.

The same gentleman has projected, and got a plan drawn out, of a line of road to branch off the one last mentioned, a little below Kildonan; to be carried in a southerly direction, through the upper parts of the parishes of Colmonell, Newluce and Inch, and to join the Dumfries and Portpatrick road, where, according to the new plan, they are supposed to meet, near Mount pleasant.

It is unquestionable, that roads are the first and most essential improvement in every country; so much so, that no other improvement can ever take place without them. It seems, therefore, a mathematical conclusion, that the more roads there are made, all other circumstances being equal, the more speedily will a country be improved. Every district will be sensible of the extent of their funds; and, wherever the funds will admit of it, roads ought to be made in all directions; and then, as in the road to Heaven, let every person take the one that is most agreeable to his inclinations.

The part of the country through which the line of road above mentioned will pass, is purely in a state of nature, and must for ever remain so without the benefit of roads for carriages. It no doubt is considerably elevated above the level of the sea; but not more so than other districts,

to which agriculture, in many instances, has been extended ; and though the soil of a great part of it be mossy and moorish, there is no saying what the increase of population, the progress of society, and the hand of industry, may effectuate. Such an improvement would not only increase the means of support, but would greatly tend to the amelioration of the climate. It is doubtful if this road could be adopted at all seasons, as a road of internal communication ; but it would open up a large tract of country, both in Galloway and Ayrshire, which, in its present state, is next to being useless to the community, as well as to the proprietors.

If this road was once made, the road by the shore to Girvan altered, the road by Barr kept in repair, the road up Dusk completed, and the alterations in the great road from Dumfries to Portpatrick executed, the shire of Wigton would then be as well accommodated with roads of external communication as any county of the kingdom.

It remains to be mentioned, though with much regret, that the roads of internal communication through the county, are far from being so good as agricultural purposes would require : But, whether the funds will admit of their amelioration, can only be known to the gentlemen of the county, to whom, by law, the sole management is entrusted. If, however, they are deficient or unfit for making good roads in every direction, appli-

cation ought to be made to Parliament for such additional powers as may be required for accomplishing so desirable an object. In a word, there is perhaps no branch of political and rural economy of more paramount importance than good roads; as, without them, every exertion to improve must be crippled and enfeebled.

The spirited and liberal-minded proprietors of Wigtonshire are perfectly sensible of all this; and at present, and for several years past, they have exerted themselves to ameliorate the condition of the parish roads. It is said they have it in contemplation to apply immediately for powers to increase the funds. When this takes place, it is hoped the road from Stranraer to the extremity of Kirkholm, will not be neglected. In particular, it is trusted that the roads, from the head of the Bay of Luce to the Mull of Galloway, and from Castlekennedy to New Luce, will meet with the attention that circumstances require. Were a new road made from the Bay of Luce up that valley so far as cultivation reaches, important advantages might be gained. In this valley there is a good deal of fine turnip soil; but, as there is hardly the vestige of a road at present, improvement is out of the question till access be opened. To the Earl of Stair and Sir James Hay, the road recommended would be of such benefit, that, if neglected by the public, it would be for their interest to execute the whole at their own expense—an expense which would

soon be remunerated by the additional rents which would be gained in consequence of such improvement. When these and similar plans of improvement are carried into execution, the shire of Wigton, which, even in its present state, contributes so much to the welfare and prosperity of the State, will become the admiration of strangers for its beauty and fertility; whilst the interest of landed proprietors will be greatly increased, and the comfort and happiness of the tenantry advanced to a height that has never as yet been attained.

AN ACCOUNT

OF THE

PRESENT STATE OF THAT DISTRICT OF AYRSHIRE —
WHICH IS BOUNDED AS FOLLOWS, VIZ.—

By the March of Galloway on the South, by the River Ayr on the North, by the Sea on the West, and Lanarkshire and Dumfries-shire on the East: Describing the various Improvements of which it is susceptible, the Means of effecting these, and the Difficulties and Obstacles which are to be surmounted; together with any local Advantages derivable to that District itself, or any other adjacent to or connected with it, from Manufactures, Mines, or Minerals.

By the Rev. Wm. DONALDSON, Minister of Ballantrae.
Written in 1811.

O fortunatos nimium, sua si bona nōrint,
Agricolas! quibus ipsa, procul discordibus armis,
Fundit humo facilem victum justissima tellus.
VIRG. GEORG. II.—43.

THAT part of Ayrshire, of which the Society wish to have an account, is of considerable extent. It comprehends twenty parishes, ou

the forty-eight, of which the whole county consists; reckoning the town of Ayr to be two. It forms nearly a triangle, the base of which, along the water of Ayr to the confines of the county on the east, is nearly thirty-three miles; and the two sides are each little short of fifty miles in length, terminating on the south at the Bay of Lochryan, in a breadth of about two miles. In round numbers, this will include a surface of at least 750 square miles, or 480,000 acres. This great extent of country is naturally separated into two unequal divisions of moor and dale. Drawing a line from near old Cumnock, along the bottom of the hills, to the shore of Ardmillan, all to the west of that line, to the sea, may be considered as arable, without almost any interruption; at least so very little; that it becomes insignificant on the map of such an extensive space. All to the west, till it reaches the confines of the county, is hilly; and there heath is the predominant covering. But among these hills, there are many extensive valleys of good arable and pasture lands. From these hills there proceed four considerable rivers, provincially called waters. The water of Ayr, and the water of Doon, which run west and north-west, and empty themselves into the sea; the first at the town of Ayr, where it forms a tolerably good harbour; and the other about two miles south of it. The water of Girvan and the water of Stinchar, which

flow south, and south-west. The first of these joins the sea at the town of Girvan, twenty-one miles south of Ayr, where there is a Bar harbour, that will admit vessels of about seventy and eighty tons burden ; the other at Ballantrae, thirty-six miles south of Ayr.

It is along the banks of these rivers that the beauties of this district are chiefly displayed. Almost all the arable part of the district is now enclosed, generally with hedge and ditch. Those parts of the higher grounds that are enclosed, are, for the most part, enclosed with stone walls, built after the Galloway plan. All along the banks of the rivers, and the streams which flow into them, there is a considerable quantity of natural wood, and also numerous thriving plantations; a great part of which have been reared by the present proprietors, and their immediate predecessors. Upon these, too, especially the three first mentioned rivers, there is a richness of landscape, and a beauty of picturesque scenery, that might vie almost with any that are recorded in song. Though the ' Banks and Braes of bonr Doon ' and the ' Banks of Ayr ' have alone been immortalized by the native bard, yet the bay of Girvan and of Stinchar, are little inferior point of picturesque scenery, to the other whatever they may be otherwise.

The lower part of the district, indeed, is a prospect that is highly interesting. A pier standing on Brown-Carrick, or Mochrum h

under his view a vast extent of a rich and finely diversified country, of a waving or undulated surface, all under cultivation ; adorned with numbers of gentlemen's seats, numerous thriving plantations, hedges, hedge-rows, belts and clumps of planting. And turning to the west, the whole firth of Clyde lies before him, apparently land-locked, from the hills above Dumbarton, round the east coast of Kintyre, and the whole extent of the county of Antrim to the loch of Belfast in Ireland. A more enchanting prospect can scarce be imagined. But however delightful this scene is at present, and however much has already been done to cultivate it, the mind looks forward with increased delight to the not distant period, when a more perfect culture will prevail, and which there is every reason confidently to expect, considering the spirit and activity that pervade both proprietors and occupiers. When that event shall happen, this district will rival, in beauty and value, some of the best cultivated districts in Britain.

As the district is naturally separated into two divisions of such opposite qualities, where the modes of management, and the produce, are so totally different ; the best way of forming a proper judgment of them, will be to describe them separately, pointing out the modes of management, and the produce and present state of each division, with the local advantages and disadvan-

tages incident to them ; and suggesting the most probable means of improving the one, and remedying the other.

It was mentioned before, that the part of the district to the west of the hills, and next to the sea, is all arable, and at present under tillage. This part coincides with the general figure of the whole district ; that is, it is of a triangular figure. The base of the triangle along the water of Ayr is about thirteen miles ; and the sides, to the foot of the hills of Ardmillan, are nearly twenty-four miles in length. This will afford a tolerable conjecture of the superficial contents, and of the immense value, of such an extent of, generally, fine land. The soil of that part of it which lies in Carrick, to the south of the water of Doon, is for the most part a strong, deep, good loam. What lies betwixt the waters of Doon and Ayr is of different qualities. The parts next to the shore are similar to that in Carrick. In the middle, the soil is for the most part strong clay. Towards the hills, a soft, spungy, peat-earth soil, prevails.

Except in a few instances, it is only within the space of fifteen or twenty years that any thing like regular culture has been introduced. Previous to that period, and after the barbarous system of outfield and infield was abolished, the system introduced by the late Mr Fairlie, upon the estate of Eglintoun, for a long time prevailed. This consisted in taking three white crops, af-

enclosing and liming, sowing grass seeds with their last crop, and then letting the ground remain in grass for the succeeding six or seven years. Just perfect as this system was, it served to promote improvement, at a time when proper culture was utterly unknown. It was considered as being a good rent, when the best lands in the county, with this culture, yielded 18s. the acre. For the last fifteen years, the new system of husbandry, or the alternate white and green crop system, has begun to prevail; though it is within a much shorter period that any thing like a general prevalence of it has taken place; and it may almost be said to have arisen, as it were, by enchantment. In making this experiment, the intelligent and active landholders, with great propriety, led the way, and had pursued it for a considerable time, before any of their tenants would follow their example. And though their efforts, at first, might not be crowned with the most profitable returns to themselves, yet they showed their tenants what could be done with more minute attention, and more economical habits. When all the landholders were sedulously employed in the cultivation of their several properties, it may seem partial and invidious to particularize any names; but I cannot avoid mentioning, that Thomas Kennedy of Dunure, Esq., early and extensively engaged in this patriotic pursuit. More than twenty years ago he took about five hundred acres of his estate into his own hand, and cultivated it after the

most approved method. Only about two years ago, he parted with it to a most active and intelligent farmer, at a rent of 1600*l.* a-year ; and it is thought to be a good bargain. Mungo Smith of Drougan, Esq., early began the improvement of his estate ; and at present, James Ferguson of Crosshill, Esq. advocate, is expending some thousands a-year upon the improvement of his different estates in Carrick, upon the newest and most correct principles. The advantages of this system are now so clearly understood, that in all the new leases tenants are taken bound to follow it, in so far as the nature and situation of their farms will admit.

Though a system of restrictive covenants cannot, upon general principles, be viewed as favourable to improvement, especially in a country already brought into a high state of cultivation, and in which the several branches of agriculture are well understood, it can scarce admit of a question that they are necessary upon a change of system, at least so long as old habits and prejudices may remain, and until the superior advantages of the new modes are clearly ascertained. It will be the wisdom, therefore, of the landed proprietors, to continue these restrictions till such time as the country is brought into a more perfect state of cultivation. When the old race of farmers have become extinct, and the rising generations, having acquired more knowledge and experience, from observing what passes in the

world around them, may be disposed to follow the beneficial example set them by others, it may be wise and expedient to allow discretionary management till the last four years of the lease, when the interest of the proprietor and occupier may be reasonably supposed to take different directions. At all events, a few restrictive clauses with respect to fallow and grass land, seem to be necessary ; as, without them, the majority of farms would be thrown entirely out of shape at the conclusion of the lease. At this time it may be said that every part of the district is, more or less, under the new mode of management ; and where other courses prevail to any extent, it is chiefly in those farms that are either occupied by old tenants, or that were under leases granted before any knowledge of such management was obtained.

The best and clearest account that need be given of the part of the district under review, is, that it has not yet by any means attained to a perfect state of culture, but that it is in a rapidly progressive state of improvement, and of advancement towards it. Farming is everywhere the *ton* ; farming societies and ploughing matches are established ; good implements of husbandry may be obtained in every parish ; a better set of working cattle are procured :—in short, there is an emulation among farmers, who shall have the best of every thing that the country can produce. All of these are favourable symptoms of future

success. But a few facts and circumstances will illustrate the actual state of improvement better than any description that can be given.

1st, The Dairy has been established in the district, and now generally prevails through every part of it; and it has been extended even into some of the valleys of the higher grounds. Scarcely any other kind of horned cattle is to be seen than the well known Cunningham breed of milch cows. By the dairy is to be understood the making of sweet-milch cheese, after the Dunlop or Cunningham method. These cheeses, when well prepared, and kept to a proper age, are reckoned to be little inferior to the Gloucester. From the whey, and other refuse of the dairy, such a number of pigs are commonly reared, as are nearly equal to the expense of management, and sometimes to a little more. However that may be, it is upon the produce of the dairy that the farmer chiefly depends for the payment of his rent; and if the ground is in any tolerable condition, and the dairy under proper management, it is perfectly sufficient for the purpose. When the stone of cheese was selling at 13s. and 14s., the annual produce of each cow was estimated at 10*l.* or guineas. This year, when it gives only 10*s.*, there must be a great deduction from that estimate. The produce of the crop is allotted to cover expenses, interest of capital, the support of the family, and the farmer's profit or remuneration for his trouble of management. Now

it is a well known fact, that a dairy cannot succeed, nay, not even be attempted, without a sufficiency of nourishing food for the cows ;—in summer, plenty of good grass ; and, in winter, plenty of good hay, with green food, either turnips or potatoes. And before any of these can be procured in sufficient quantity, to answer the purposes of a dairy, a considerable progress in cultivation must have been made. Upon the increase of that cultivation, the increase of the dairy will depend.

2d. The raising of wheat is no unfair criterion by which to decide the actual state of cultivation. Before wheat can be cultivated successfully, the ground must be thoroughly drained and cleaned, either by a naked or green-crop fallow. It must be brought into a proper tilth and pulverization, by the plough, and roller, and harrow, and sufficiently manured. Good aration, draining, cleaning, and manuring judiciously, are the very essentials of good farming ; and wherever these are so executed, and prevail to any extent, it is a sure symptom that agriculture has made considerable progress. And these again will lead, in their train, to an increase of green crops, and of manure, that will still further strengthen the farmer's hands, and accelerate his progress.

In former times, and at no very distant period, there was very little wheat raised in Ayrshire, and next to none in this part of it. The writer of

this article remembers the time when, in the parishes of Maybole, Kirkoswald, Dailly, Girvan, (now the best wheat parishes in the country), and in the three parishes on the Water of Stinchar, there was scarce a bushel of wheat sown. It is in the knowledge of many persons yet alive, that an opinion generally prevailed that this country was unsuitable for the growth of wheat. That there was ‘a something’ in the nature of the soil, or of the climate, which rendered the wheat unfit to be manufactured into flour, or good wholesome bread. The experience of modern times has shown how ill-founded this opinion was. Wheat of the best quality is now extensively cultivated within this district. As a proof of this, it may be mentioned, that from the parish of Kirkoswald alone, there was exported, last season, rather upwards of three thousand bolls of wheat. It is no doubt true, that the greatest breadth of ground is still sown with oats; but it is equally true, that the culture of wheat is annually increasing; and, so sensible have farmers become of its value, that there are very few who do not endeavour to have a portion of their farms occupied with that valuable grain.

3d, The value of land, or the actual rent paid for land, is no unequivocal mark by which to judge of the state of agriculture. It is very true, that this will in part depend on the value of farm produce, and the state of national security and prosperity at the time. But it is an ob-

servation obvious to every capacity, and founded on experience, that the chief cause of the increased value of landed property, is the superior modes of management that have been introduced of late years, by which a tenant is able to raise as much produce, and of superior value, in one year, as he formerly could have done in two or three. If we are allowed to judge by this rule, it is evident that this district has made, and is continuing to make, great agricultural progress. A farm can now pay two, three, and four pounds, or guineas, the acre, which, forty or fifty years ago, could scarce have yielded as many shillings. And it is perfectly evident, that the tenants live better, and are in every respect better accommodated now than they were at that time. The value, and the demand for farms, have been on the increase for a considerable time back, and probably will continue so for many years to come, unless some great unforeseen calamity shall intervene.

These circumstances may afford some *data* by which to estimate the present state of this district. And from these it will appear to the Society, that it is a district solely devoted to the purposes of agriculture. There are no manufactures of any consequence established in it. The works of coal and lime and freestone that are carrying on, are subordinate objects, and valuable chiefly as they contribute to the improvement of its agriculture, and the comfort of its

cultivators. The country is not yet become so populous as to afford a superfluity of hands for manufactures. All that can be spared from necessary mechanical employments, from the coasting trade, and from the defence of the country, are at present required for the cultivation of the ground. And in that case, the establishment of manufactures, upon any thing like an extensive scale, would be more apt to injure than to promote the advantage of the district. The habits and the ideas of the people are all agricultural; and these seem at present to centre in the operations of the dairy, the value and the demand for the produce of which have of late very much increased. It is wise and prudent in them to direct their chief attention to that from which their chief profits are derived, rather than to distract their minds with a multiplicity of different pursuits.

As this part of the district is distinct from, and, in a great measure, independent of the other, it may be as well, in this place, to take notice of some local circumstances that have a tendency to promote or retard its prosperity, before we proceed to the consideration of the other division.

The most prominent circumstances affecting this part of the district, is its contiguity to the sea. The sea forms the western boundary of the district, from the town of Ayr to within a mile of the Cairn at Lochryan; and, if measured a

long its margin, this line would extend to nearly fifty miles. Along this coast there are several harbours and roadsteads for vessels. The town of Ayr (which is within the district) is a place of considerable trade, both foreign and coasting. At Girvan, as already mentioned, there is a Bar harbour for vessels of inferior burden. Thomas Kennedy Esq. of Dunure, is just now erecting a harbour upon that coast, at his sole expense, for which he has obtained an act of Parliament. When this harbour is completed, there is every reason to hope that it will be beneficial, not only to his own valuable estate in that neighbourhood, but also to every other one contiguous. A subscription has been entered into for the improvement of the landing place at Ballantrae, in order to render it more safe and commodious for the importation of lime from England and Ireland, and for the exportation of farm produce. From all these places, as well as some others along the coast, the surplus produce can readily be exported to the Clyde, or to England and Ireland, and lime and other necessaries for the country be imported. To all these places there are excellent roads of communication for conveying commodities; and no part of this division of the district is at such a distance from the sea as to be deprived of the benefit of them.

There is another circumstance connected with this, which ought not to be omitted; and that is, the great quantities of nutritious aliment which

is procured by the inhabitants from the fish caught along the coast. It is about fifty years since any such great shoal of herrings arrived there as could furnish a subject of exportation; but there is generally a sufficient supply of the various kinds of sea-fish at all seasons of the year, such as, cod, ling, haddock, skait, turbot, halibut, and frequently a few herrings. And in the rivers Doon, Girvan, and Stinchar, such quantities of salmon are caught every year, as afford a considerable rent to the proprietors.

The sea affords another advantage of the utmost consequence to the inhabitants along the coast. As these are generally at the farthest distance from lime of any within the district, this want is, in a great measure, supplied by the immense quantities of the very best sea-ware. This valuable boon which Nature supplies, is found to be an excellent manure for the generally light free land that is situated within a mile or two of the sea; whether it be spread on and ploughed down immediately as it comes ashore, or be mixed up in compost with dung and other substances. Excellent crops are raised with this manure, which has this additional recommendation, that the crops are not polluted with the annual weeds that are too often carried out among common farm-yard manure.

The most eminent advantage which this district possesses, (and which is common to it with the whole extensive county of Ayr), is its ready

access to manure. There are coal and lime almost in every quarter, in great abundance; and marl, both soft and hard, in many places; besides quarries of the best freestone every where; with good turnpike roads, in all directions, for their conveyance. To a country in a state of nature, lime is of the first necessity to bring it into cultivation. And the great exertions which this part of the country has been able to make, in so short a time, are no doubt owing, in a great measure, to the plenty of coal and lime which it possesses. The usual practice, hitherto, has been, to lay from 150 or 160 to 240 bushels of unslaked lime on the acre of grass land, at first breaking up, according to the quality of the soil. And after two white crops, in order to pulverize the soil, it is either continued in alternate cropping, or the farmers upon the old leases sow grass seeds with a third crop. Better modes are daily gaining ground. Fallowing is practised before the application of lime: A quantity of lime is frequently spread on after potatoes for a wheat crop, as also upon summer fallow, where a wheat crop is intended.

It is difficult to state accurately the annual produce of the several crops, as this must vary according to the nature of the season and of the soil, and to the culture which the land may receive. It may be mentioned, however, as a probable conjecture, that six Ayrshire bolls (quarters) of oats are a fair average crop on tolerable

good ground. Barley and barley may, perhaps, not yield so much; but of these there is not a great quantity sown since the additional malt duty was laid on. Of wheat there are only four bushels given to the boll; and the produce of this crop varies from seven to ten bolls. Eight bolls are considered as a middling crop; ten as a good one: but either of these, at the price of wheat of late years, pays better than any other crop. Of this last grain, it deserves to be mentioned, that whether it be owing to the newness of the culture of wheat in the country, or any thing in the nature of the climate or otherwise; it is certain there are not such frequent complaints of rust or mildew here as in those districts where the culture of wheat has longer prevailed. The frequent south and south-west blasts from the Atlantic Ocean may, perhaps, tend to counteract that dreadful malady. Beans are cultivated by every judicious farmer in drills. Peas are sown broadcast. The turnip husbandry prevails to a considerable extent. But it is generally allowed, that the crop after potatoes exceeds that after turnip. Whether this be owing to the climate, or to the mode of management, is not yet fully ascertained. Perhaps both may come in for a share of the deficiency. A greater quantity of rain falls upon this than on the opposite side of the island, which may expose the ground to more injury from horses and carts when removing the turnip during the winter season. But the chief

reason may rather be, that as wheat is now commonly sown after potatoes, the ground receives a portion of either lime or dung before the seed is put into the ground; while early oats, or bear or barley, are commonly sown after turnip, without that additional stimulus.

Notwithstanding the progress that has been made, of late years, in the culture of wheat, and these other esculents, it must yet be allowed that oats are still cultivated to a greater extent than any other species of grain.

The most unfavourable circumstance to which this district is subjected, is the climate. From its contiguity and exposure to the western ocean, as already observed, much more rain falls than on the eastern coast. This prevents that perfect aration, and complete fallowing, that is requisite in true farming. This is an inconvenience which can scarcely any otherwise be removed, or alleviated, than by due attention to draining, and to keeping all the ditches and conduits for the water perfectly clear.

The want of a corn market is much felt in this district. One has been often talked of, and proposed, but has not yet been established. A corn market at Ayr, or Maybole, or at both places, would be of vast advantage to the farming interest, as well as to the community at large. And, therefore, the gentlemen at their public meetings, or the farming Societies, could not possibly exert

themselves more profitably for the good of the community, than by endeavouring to bring about this desirable object.

The only other circumstance that need be mentioned in this place, as tending to retard the progress of improvement, is one that every day is remedying; namely, the want of agricultural capital: It is perfectly obvious, that wherever a farmer is stinted in point of capital, he can make no great exertions; for money is the sinews of farming, as well as of war. The farmers in the district are generally in easy circumstances; but there are few who have very large farms, and still fewer who have that entire command of capital that would enable them to stand any great shock, or to risk an experiment, if attended with much expense. A farmer is liable to many accidents; perhaps more so than men of most other professions. He is exposed to unfavourable seasons, which no human power or ingenuity can ward off; to fluctuating markets; to losses and failures in business; besides many other casualties. And when any, or all of these occur, and he has nothing to meet them but the annual produce of his farm, it is perfectly evident that, from want of capital, he must be fettered in his operations for years to come. Time, and the progress of society, will supply this want; and there is reason to hope it will soon be felt no longer. Farming is now considered as not below the attention of a gentleman; and practical farmers hold a much

more respectable rank in society than they did formerly. Their minds are daily becoming more enlarged, from their more frequent intercourse with one another. They live better; and in every respect seem more comfortable and more respectable. These are favourable symptoms of their future improvement, and afford strong inducements to men of education and large capitals, to engage in farming pursuits. Upon the whole, there is every probability that the time is not far distant, when this district, naturally beautiful, salubrious, and fertile, will equal, in point of improvement and prosperity, any other district in the country.

There is one evil, against the baneful consequences of which it becomes all the friends of substantial improvement, and social order, to be on their guard. In former times, this district, from having so great an extent of sea coast, was much exposed to the nefarious trade of smuggling, but which, for a long period, has been utterly extinct. If ever it should be again revived, upon the return of peace, it will be the interest, as it is the duty of every landholder, to set his face decidedly against it, as being injurious not only to morals, but to the best interests of society in general. There is one easy and simple way by which an effectual stop might be put to it. Let landlords, whose property is contiguous to the sea, insert a clause of forfeiture of lease, with a

high additional penalty, in every tack, if the tenant shall be found either engaged in smuggling himself, or to have given a domicile to any one engaged in it. If this, or any similar plan, was universally adopted, these pests of society would soon be extirpated from the face of the earth.

The other division of the district under review is of larger extent, and of a very different quality from the one already described. It stretches from Muirkirk on the confines of Lanarkshire, along part of Dumfries-shire, a great extent of the Stewartry of Kirkcudbright, and nearly the whole length of the county of Wigton, from the water of Cree to the bay of Lochryan. The breadth in many parts is unequal, from that eastern line being so very much waved or indented. The figure of this part is also triangular; for the north end is nearly ten times broader than the south, but it is not so well defined as the other.

The whole of this immense tract is hilly, or rather mountainous; of a soft, spungy, and mossy soil; but with many extensive, beautiful, and fertile valleys interspersed. It is adapted to the breeding and rearing of black cattle and sheep; and, except in a few instances, it is solely appropriated to these purposes. The cattle are of the Galloway breed, which, after having been transferred successively from pasture to pasture, are, at three or four years old, driven up to supply the English markets. The sheep are generally

of the black-faced kind; and, at two and three years old, are bought up by jobbers for supplying the towns and villages in the interior parts of the country. Some few of the Cheviot sort have been introduced, and are said to thrive nearly as well as the native breed.

If a stranger would wish to form a just conception of the topography of this division, he must extend his visit to the source, and along the current of the rivers that have been mentioned, which have their origin in these higher grounds. It is by the valleys formed by these, and in which they flow, that the bleakness of the prospect is diversified; and the beauty, the healthfulness, and the fertility of the country, enlivened and promoted.

Along the Nith, in New Cumnock, there is a great deal of excellent fertile land, insomuch that the dairy is carried on there to a considerable extent. Coal is in such plenty, that all that is necessary is only to go out with a pick and shovel and take up what is wanted. Limestone and ironstone also are found in abundance, and of the best quality. At Dalmellington, near the source of the Doon, there is a great deal of meadow and holming ground. At Straiton, where the Girvan takes its rise, there is still a greater extent. All along the course of this river, there is a valley of most excellent land, adorned with a great number of elegant seats and extensive plantations, besides natural wood. In point of real

beauty and fertility, the valley of the Girvan may vie with any (I had almost said) in Britain. On this river stand the houses of Kilkerran, Dalquharan, Bargeny, Killochan, Trochregue ; besides some others of inferior note. The Stinchar takes its rise in the head of the parish of Barr ; and, after flowing in a clear, meandering, and limpid stream, through that parish, and the whole length of the parishes of Colmonell and Ballantrae (a distance of more than twenty-five miles), it falls into the sea about a mile to the south of the village of Ballantrae. There are two considerable streams, viz. the Astel and Dusk, which fall into this river, besides innumerable rivulets. And all along the course of the principal river, as well as of its branches, there are many thousand acres of fine dry arable land, fit for the turnip husbandry. The dairy has been set up on some farms on this river.

As black cattle and sheep are the great staple commodities of this division, their proper management is a matter of the utmost importance.

The practice of smearing sheep with a mixture of tar and butter, (provincially called *laying* them), at the beginning of winter, universally prevails ; though the propriety of that application has been very much disputed, at least by speculative farmers. The reasons assigned for this practice are, that it improves the wool, contributes to the growth and health of the sheep, and enables them better to stand the winter storms. We do

not mean to enter upon the discussion of this disputed point. It may only be observed, that to a person unacquainted with the arcana of the business, the most beneficial effects of smearing would appear to be the certain destruction of the numerous vermin with which it is known the animal is infested and tormented. If any oily substance, having such ingredients mixed up with it as would effectually destroy these vermin, were applied to the sheep when shorn, or at such other times as were judged proper, one would be apt to suppose, that all the most useful purposes of smearing would be obtained, and at much less expense, and less trouble to the animal. It is a certain fact, that in former times no smearing was practised to the north of the Forth. And yet, more than sixty years ago, sheep were sold off the Ochil hills, in Perthshire, at 10s. a piece ; and it is well known, that these hills are as much, if not more covered with snow during the winter, as are the hills in this district.

The other details of managing both cattle and sheep, do not admit of even such an excuse as is made for the practice of smearing. Neither cattle nor sheep have any shelter provided to defend them from the winter storms. The milch cows and calves only are housed. All the other cattle are kept out in the fields during winter, on a small allowance of the coarsest hay. The sheep are permitted to roam about ; and, like the fowls of the air, and the fishes of the sea, to live upon

what they can pick up of nature's bounty. The consequence of this is, that not only many of them die, but those who live are in such a state of poverty at the beginning of summer, that the season is far spent before they recover. It is true, indeed, that towards the north-east quarter of this district, about New Cumnock, and in that neighbourhood, where there are the greatest and longest falls of snow, the farmers have been long accustomed to mow the long bent and sprat, and stack them up for their sheep when the ground is covered with snow. Though all the hills of this district may not be equally green with these, yet there are few places where some provision of the same kind might not be made.

But it is not altogether the quantity, but the quality of the food, that ought to be attended to. Where there are such vast tracts of arable land, fit for raising turnips, potatoes, and sown grasses there does not seem to be a single excuse for the want of a sufficient quantity of wholesome and nourishing food for live-stock during the winter season. If a few turnips were given them, from the beginning of winter, when moor grass begins to grow dry and sapless, it would serve to keep them in good condition, and it would also be a means of preventing some diseases, to which sheep, particularly, are known to be liable. A storemaster might not be able, in every instance, to provide a sufficiency of turnips for his stock; but if the young and feeble were suf-

with them; the stronger and older sort would subsist upon hay.

Shelter, and a dry bed, are as necessary for the health and productiveness of animals, as a sufficiency of food; and it is altogether surprising how little this is attended to. There is very little shelter any where, except what nature has provided, by the inequality of the surface. It is scarce to be supposed, that covered shades could be erected by ordinary farmers, sufficient to accommodate large flocks and herds; but crosses and triangles of high stone walls might, at very little expense, be raised upon different parts of almost every farm, to which the cattle and sheep might fly for shelter from the fury of the raging tempest, or the burning heat of the summer sun. The best of all shelter, perhaps, is that which is afforded by plantations. These could not be made by a tenant without the proprietor's consent, nor without certain stipulations of receiving an indemnification at the end of his lease. But if we could suppose that one or more plantations were reared upon every farm throughout this division, it is not to be imagined how great would be their value as shelter for the live-stock, and how much they would adorn the landscape. And upon these extensive wilds and wastes, where the ground is generally of small value, plantations might be made at little more expense than that of enclosing the ground, and protecting the plants from injury, till they were out of the reach of cattle and sheep.

But farther, as this part of the district is naturally wet and spungy, the draining of the surface would be a vast improvement. And this might easily be accomplished by drawing furrows with a plough, where that was practicable, or otherwise by small drains made with a spade, in order to intercept the surface water, and to convey it into one conduit in the hollow ground. This operation would improve the quality of the pasture; and, what is nearly of equal benefit, it would afford a more safe and comfortable bed to the animals. The rot, and other diseases incident to sheep and cattle, may in a great measure be ascribed to an excess of moisture. Enclosing, planting, and draining, being permanent improvements, and of the same nature with the farm buildings themselves, substantial justice requires that they should be executed by the proprietor, upon his receiving either an additional rent, or a certain per centage on the outlay; or become the joint charge of proprietor and tenant, upon certain stipulated conditions. And no prudent tenant will grudge to pay an adequate interest upon any sums that may be expended for these purposes.

Though the general character of this part of the district be hilly and mountainous, and the nature of the soil spungy and wet, and seemingly incapable of any other improvement than enclosing, draining, planting, and the different modes of providing shelter; yet, throughout the

whole, there are extensive tracts of fine dry arable land, in the valleys above mentioned; the produce of which is much more than sufficient for the consumpt of the inhabitants. From the lower part of the parishes of Colmonell and Ballantrae, particularly, quantities of wheat, oats, bear, and oatmeal, are annually exported. The communication with all these places has been facilitated by good roads, made and making in all directions; so that, throughout this whole extent, there is no part of the arable ground that has not ready access to coal and lime, and other manures and means of improvement.

In order to have a more distinct view of the progress of improvement in this part of the district; it may be proper to mention more particularly what has already been done, and the plans that are just now carrying on for opening up the country.

The era of improvement in any country must be dated from the making of roads, and the building of bridges. Before the year 1774 or 1775, when the first Road Act was obtained for this county, there was scarce a road any where upon which a cart or carriage could travel with any tolerable safety. At present there are few counties in Scotland better accommodated with good roads. These indeed, as frequently happens at first, were, in some instances, laid out in such an injudicious manner, that frequent expensive alterations have been required. The great road to

Portpatrick, by Kirkoswald and Girvan, along the shore, was made many years since. A branch from this road strikes off at Maybole, down the water of Girvan; and a second, about a mile south of Girvan, goes round by Penmore and Colmonell, and joins the post-road at Ballantrae. A road goes from Ayr to Edinburgh, by Old Cumnock and Muirkirk; another to Dumfries, by New Cumnock and Sanquhar; a second to Dumfries, by Dalmenyington in another direction; and there is also a road to Straiton. All of these were made long ago; and there are numerous branches intersecting, and collateral to these, formed since, for the internal communication. Of a later date, a road has been made from the water of Girvan, through the head of the parish of Dailly and Barr, down the Minnoch and Cree, to Newton-Stewart in Galloway. About two years ago an excellent road was opened up, at a considerable expense, by Sir Hew D. Hamilton, through his estate upon the valley of Astle. And in the course of last summer, a most necessary road has been making from Old Dailly, on the water of Girvan, cross the hills to the Barr, upon Stinchar. These two last mentioned roads open up a communication with some of the best limeworks in the country, for supplying the parishes of Colmonell, Girvan, and Dailly, with that necessary mean of cultivation. From the Colmonell road, near to Daljerrock, upon Stinchar, a

new road has been planned, and is just now executing, to go up the valley of Dusk, and to join another road from Galloway, at the march of the county. And it is in contemplation to carry a branch from this road south, through the parishes of Colmoitell, and New Luce, and Iachlin in Galloway, to join the great Dumfries road to Ireland by Portpatrick. Thus, communications are everywhere opened up, for the conveyance of farm produce, and of coal and lime. It is in a great measure owing to the spirit and exertions of the gentlemen who projected, and carried into execution, these public works, that a general spirit of improvement has been excited, and has been rapidly diffused.

Yet it must be confessed, that throughout the southern part of the division of the district under consideration; through the whole length of the extensive valley of Stinchar, and the branches communicating with it, proper agricultural improvement is very far behind. All along the whole extent of this valley, of twenty-five miles in length, and along the banks of the various streams that flow into it, the country, indeed, abounds in enclosures, (for the most part stone walls), for the purposes of grazing; but in other respects, it may almost be said to be in a state of nature. In this space there are many thousand acres fit for every species of husbandry, especially for what is called the turnip or green-crop husbandry, which the country much requires; but

it is only in a very few instances that the experiment has been made, though in these the success has been most encouraging. This slow progress is in great part owing to the distance from markets, and, till lately, to the want of good roads; but it is chiefly to be ascribed to the state of property. It is here that a considerable part of the extensive domains of the Bargeny estate are situated. The late worthy proprietor, John Hamilton, Esq. a year or two before his death, gave long leases, upon easy terms, to the old tenants, without almost any prescribed mode of culture. Being unaccustomed to any other kind of farm management, than the breeding, rearing, and grazing of sheep and black cattle, after the old fashion, which of late years has been abundantly lucrative, and being thus able to thrive, and live comfortably, without any great exertion, these men had no strong stimulating motive for exercising their ingenuity. This state of things proves, in a convincing manner, what has often been asserted, that a fair, equal rent, is beneficial, not only to the proprietor, but to the tenant himself, as well as the community at large. It rouses and calls forth the powers of genius, which in different circumstances might remain torpid. In such trials as have been made in the district of Stinchar, by new tenants, from other parts of the country, as good wheat, beans, barley, oats, turnip, and potatoes, have been raised, as any where else.

The Society, at their meeting in January last,

offered a premium of ten guineas for a ploughing-match, to take place in some one of the three parishes upon the water of Stinchar, which has been attended with the best effects ; and it would be of the utmost consequence, in order to fan the spirit that has been excited, if they would be pleased to continue it for another year.

The woollen manufactory has been tried upon a small scale in this part of the district ; and carding and spinning machines, at different times, have been erected in several places ; but, excepting the weaving of coarse plaiding and blanketing for the American market and home consumpt, this trade has not succeeded. This failure may be owing to various causes, such as the want of capital and judgment among the manufacturers ; the want of an overflowing population ; and chiefly, above all other causes, to the want of such division of labour as takes place in England, and in other manufacturing countries.

The only great works within the district are the iron works at Muirkirk, where bar iron and other articles are manufactured. Throughout that parish, and the two Cumnocks and Auchincleck, coal and iron stone are found in the greatest abundance. And from the appearance of the water that issues from the springs among the mountains, the latter mineral would seem to extend much farther. But though ironstone or ore were discovered in these uplands, it could not be wrought with much profit, on account of their dis-

tance from coal, and the expense of the carriage of materials.

Considering the mountainous and elevated situation of this part of the district, there can be little doubt that various other minerals may exist; but, though attempts have been made at different times to discover them, none have been yet found worth working. A trial for lead was made some time ago in the parish of Barr, at the head of the water of Stinchar; and the late John Hamilton Esq. of Bargeny made another on his estate in Glenapp, in the parish of Ballantrae. Though the appearances in this latter place were reported to be flattering, and the situation is peculiarly favourable from its being within little more than two miles of water carriage, at the Bay of Lochryan, yet he did not chuse, in his old age, to prosecute the trial to any extent. Appearances of a copper mine of good quality, have been lately observed upon the confines of the Bargeny and Ardmillan estates, in the parish of Girvan, within a mile of the sea; but little or no investigation has hitherto taken place to ascertain its value.

Quarries of slate have been found in different places; and, in particular, one has been lately opened, and is just now working, on the estate of Kildonan, belonging to Dr. Hamilton and James Ferguson Esq. of Crosshill: and it is said there is another vein of the same kind upon the adjoining property, belonging to Mr. Snodgrass, Buchanan. It is probable that these are a continuation

of the slate quarry which has been wrought, for a long time, on the Cairn estate, on the Bay of Lochryan, and which runs across the country from thence to the water of Dusk, in the parish of Colmonell, appearing almost on the surface in different places. These quarries must be of use for the internal consumption and improvement of the country, but can scarcely ever afford an article of trade, on account of their distance from the sea, and the consequent expense of land-carriage, while there are so many slate quarries elsewhere, lying contiguous to the shore.

From the foregoing description it will appear, that the whole of the district of which the Society requires an account, is at present devoted to the purposes of agriculture—corn, cattle, sheep, and the produce of the dairy, being the staple commodities of it; and to these the attention of the inhabitants is chiefly directed. It was a long while before any thing like proper cultivation took place in it; but, of late, it has rapidly spread. And if the many respectable proprietors belonging to the district shall extend their fostering care, as they have hitherto done, to roads, bridges, and other branches of the public police, and shall continue to make experiments of the most improved modes of culture, which tenants might not think it prudent to be the first to attempt, this district, having the means of improvement within itself, will probably become as valuable as any other of the same extent in Scotland.

In order to accelerate that improvement, it would be of the greatest advantage to have a market for the sale of cattle and sheep established in some convenient and central place within the district. This would tend to mitigate, if not utterly prevent, a sore evil, to which the farmers in the higher parts of it are frequently exposed. There is a set of men who go about as jobbers, or middlemen, and purchase cattle and sheep for the home and foreign markets, and who either drive them themselves, or sell them to others who carry them to market. These are almost always purchased on credit, or with bills at three or four months date, which are indorsed and got discounted by the sellers. If the speculation be successful, all is very well, as the purchaser takes up his bill from the bank when it falls due; if otherwise, it returns upon the seller, who, in that case, is often reduced to the greatest distress. As these jobbers and middlemen have frequently little more than the credit of a fair character to set out with, and as they deal to an unlimited extent; when they meet with any shock, it is well known that their speculations have often reduced a whole country side to nearly a state of bankruptcy. A cattle market would help to change this imprudent system, by introducing the practice of purchasing for ready money, the only sure way in which the trade can be carried on.

Besides the town of Ayr, there are several populous villages within the district; such as, May-

bole, Girvan, Old Cumnock, with many less considerable. In all of these, there are numbers of shopkeepers and mechanics for supplying the demands of the country; but there is nothing that merits the name of a manufactory any where, except the works at Muirkirk above mentioned; though the weaving of muslin is carried on to a great extent, for the manufacturers of Glasgow and Paisley. While trade is brisk and flourishing in these chief marts, vast numbers of weavers arrive from the northern counties of Ireland, and take up their temporary residence in these villages. While they remain, the district gains something by their consumption; but it suffers by the corruption of morals which they too frequently bring along with them, and but too successfully diffuse among the common people. It is extremely doubtful, in the present state of capital and population, if any other extensive manufactures would be beneficial. But as the wealth and population of the district increase, a woollen manufacture, established on proper principles, and conducted by men of capital and experience, might be of great advantage. In the mean time, it would seem to be wiser and safer to continue to sell the wool to England, or wherever a market can be obtained, than to risk such an experiment.

The district to which these observations apply, being almost entirely an agricultural one, having

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no public works of any consequence established in it, can have very little connexion with any other parts of the country, except what arises from the disposal of its surplus produce, and the purchase of such articles as comfort, conveniency, or necessity may require. But, in this point of view, it is far from being unimportant in the scale of national consequence. For, besides the supplies which such an extent of a flourishing country affords for the support of the State, and the employment it gives to about thirty thousand inhabitants, which at the least it contains, it furnishes food and clothing to many thousands more beyond its boundaries. Glasgow, Paisley, Greenock, and other towns and villages in the west of Scotland, are, in part, supported by the grain and meal, the cheese, the beef and mutton which this district produces. Bullocks and wool are sent to England; and some coal is exported to Ireland. Besides returns in money for these articles, the inhabitants obtain a great many indispensable commodities which their own country does not furnish. Thus, a friendly intercourse is established among different districts, as members of one great society, for the supply of each other's wants, and the united support and security of the whole system.

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ACCOUNT

DISTRICT OF ARGYLE AND INVERNESS-SHIRE, HAVING
THE ATLANTIC OCEAN ON THE WEST; THE SOUND OF
MULL ON THE SOUTH; LINNHE LOCH, LOCHEIL, AND
THE CALEDONIAN CANAL TO LOCH LOCHY, ON THE
EAST; AND ON THE NORTH, LOCH ARCHAIG AND LOCH
NEVASH.

Written in 1812, by the Rev. JOHN WATSON.

Rura miki et rigui placeant in vallis amnes.

FROM various considerations, the Highlands of Scotland are highly interesting. To the political economist, the philosopher, and the naturalist, they afford subjects of curious research. Nor to the mind of the rural economist are they less important. To develop the resources of this part of the country; to improve its agriculture, and better the condition of its people; while it

is pleasing to the philanthropist, is also of great importance in a national point of view. Only a portion of it, comparatively small, comes at present under our consideration. Its extent, however, is still considerable, exhibiting many varieties of soil, surface, climate and culture. Its surface is mountainous ; its soil, in general light, approaching, in some parts, to a loam ; its culture indifferent ; and its climate moist. Its proximity to the Atlantic ; its lofty mountains attracting the vapours exhaled from that ocean, and conveyed towards them by the westerly winds which prevail here ; may be assigned as the chief causes of the humidity of the climate.

But however pleasing and interesting it might be, to consider this portion of the Highlands in the different views above stated ; to enter upon them particularly, would be foreign to the design of the present Essay, whose object is confined to its Rural Economy alone. For the sake of perspicuity, we shall consider,

I. The present state of this district.

II. The means best adapted for its improvement.

III. Some of its advantages and disadvantages.
And,

IV. Make some remarks on its manufactures.

I. ITS PRESENT STATE.

The district under consideration is almost an island, having the sea on the south and west. On the east it is bounded by the sea likewise, as far north as Fort-William, where it receives the river Lochy, connecting it with Loch Lochy, which is again joined to Loch Archaig by the river of the same name; so that a small part of Glendessary, between Loch Archaig and Loch Nevis, excepted, (which make its northern boundary), it has on all sides the sea, lakes, or rivers. Its general feature is mountainous, with many beautiful valleys; but, compared with its extent, the quantity of arable land is small, and its mode of culture very imperfect. The backward state of its husbandry is owing to various causes. The mode of occupancy—want of capital and knowledge among the farmers—their aversion to innovations, and attachment to ancient customs, may be mentioned as some of these. Their implements are rude, generally made by the farmer or his servants; used often in the most awkward manner; and quite unfit for improved farming.—But changes to the better have been and are fast taking place; prejudices are yielding to knowledge; and the farmer's eyes are opening, to see the necessity of a new system, if he would either retain his farm, or better his condition. An improved system is accordingly making considerable

progress, partly owing to the landlords, partly owing to some active intelligent tacksmen,—to the rise of rents, and a diffusion of knowledge. Of this, every one must be satisfied who has seen the changes which a few years have produced.—Oats, and barley or bigg, are their only grain crops, chiefly the latter; and in many places these crops are cultivated so many years in succession, that yearly applications of sea-ware alone prevent the soil from being reduced to perfect sterility. Potatoes, however, are the most productive crop, and usually of the best quality. They are commonly planted in the way of lazy beds; but the more expeditious, and equally beneficial way of planting them with the plough, is practised by all the tacksmen, except where particular causes render the other mode more eligible. The more intelligent of the tenants also, in this district, are trying the green-crop husbandry; not, however, to the extent it merits, though, it is to be hoped, experience will soon prove its utility, and encourage its more general adoption. In general, the plough is drawn by two horses; yet, in the northern parts of the district, and the adjacent one of Glenelg, the harrows in some instances are still yoked to the horses' tails. There is hardly any such thing as a regular rotation. Lime is getting into repute; abundance of it is found in Kilmallie, and in the island of Lismore. Shell-sand is found on various parts of the coast. Great quantities of sea-ware are drifted on the coast,

which is an excellent manure; but, until agriculture make greater progress, these will not be valued as they deserve. The greater part of this district is still without sufficient enclosures, so necessary for successful corn husbandry. The tacksmen, in general, have very comfortable dwellings; though little can be said in favour of those of the smaller tenantry, which are mostly bad.

Such is the general state of this country in an agricultural point of view, though there are several exceptions, particularly on some lands in the neighbourhood of Strontian, and in various parts of Ardgour. An Agricultural Society has been formed at Strontian,* which, if properly conducted, must produce very happy effects, as is evident from what such Societies have done in the different parts of Scotland in which they have been established.

II. THE MEANS BEST ADAPTED FOR THE IMPROVEMENT OF THIS DISTRICT.

It is evident that pasture must ever be the great object of the farmer here; and for this the country is well adapted. Black cattle, till some

* Although turnips be grown in this district, they are in such small quantity, that no one was found entitled to the prize offered by this Society for the greatest breadth of land under this crop last season.

time ago that sheep were introduced, formed the principal live stock. Without mentioning the other advantages of a sheep stock, they can feed with safety and in plenty where cattle could not travel but with danger, nor even subsist. The great objection to stock of this kind, viz. depopulation, has happily been completely removed; the Highlands having increased in population considerably during the last ten years, as has been proved by the late census. As an addition to his live stock, I would earnestly recommend to the farmer the feeding of swine. This, I am convinced, he would find a most advantageous speculation. Some of the farmers in Ross-shire have had experience of this. The quantity of bacon exported by them is very considerable; and if smoked with the juniper, which grows in various places here, it might rival even the hams of Westphalia. A treatise on this subject, by Mr Henderson at Broomhill near Annan, is well worthy an attentive perusal.—As, then, the farmer's attention must chiefly be directed to his live stock, of sheep, cattle, swine, &c. it is a most important consideration, how he is to maintain them during the winter and spring months; for many of them, before the new grass springs up, are in the most wretched condition. The first and most essential improvement, therefore, is the cultivation of—

1, *Green Crops.*—The wetness of the climate,

and especially the early autumnal rains which lodge the corn crops and prevent their ripening, or delay their cutting till shaken by the equinoctial gales, is, of itself, favourable to green-crop husbandry, for which also the soil is well adapted. Every species of green crop may be cultivated here with singular advantage. Turnips, carrots, cabbage, colewort, &c. grow well; and, if cultivated to the extent required, would enable the farmer to bring his stock to market in good condition, and give him an immense supply of dung. The yellow and Swedish turnip richly merit his attention, not only for their nutritious and succulent qualities, but for their power of resisting the winter frost, and their being in perfection in the spring months, when they are most of all wanted; this being the time when cattle usually fall off, sometimes not recovering till the summer be considerably advanced. The carrot is another species of green crop which would suit this district, as it delights in a free open soil. They are well known to be excellent food for horses, which, in a moist climate such as this, is a consideration not unworthy of attention, and where, besides, the small breadth of arable land must always limit the quantity of grain which can be grown. An excellent essay on the culture of carrots, by Alphonse Leroy, from *Bibliotheque Physico-Economique*, may be seen in the Repertory of Arts, &c. Nos. 56. & 139. New Series. Parsnips, too, a rich and nutritive root, together with cole, cab-

bage, &c, would probably thrive well in this district.

Potatoes ought to be esteemed one of Providence's greatest blessings. As the soil here suits them well, they are grown in considerable quantities. To detail their mode of culture, which is so well known, would be unnecessary. They are a good first crop on moss or waste lands; and, except in such a case, the drill is certainly preferable to the lazy-bed way, as the land can be better worked and cleaned. As all plants long grown on the same soil are apt to degenerate, this can easily be prevented, either by a change of seed, or by raising them from the plum, by which many varieties are obtained for selection. Besides these, we would recommend the culture of yams. I know some Lothian farmers who annually plant them. The horses and cattle are fond of them. They are usually very productive; about fifty bolls per acre.

Having taken a green crop from the land, which it is supposed has been limed, dunged, and completely cleaned, the farmer will next take a crop of grain with clover and rye-grass. Barley and oats are, I apprehend, the only kinds of corn which would be eligible. From five to six bolls per acre is about the average of the former; occasionally, as happens sometimes everywhere, much more. Even sixteen bolls of barley have been raised from an acre. This, however, is extraordinary. The best carse lands upon the Forth in

Stirlingshire, do not average above eight, or from that to nine ; and by the average alone can you estimate the produce of land. Of oats, the produce is still less, sometimes not above three, or from that to four bushels ; but, upon an improved system, and after a green crop, we may reasonably expect a considerable increase. At any rate, the farmer may look forward to a good crop of hay the following year, which will enable him to feed his live stock in the winter months. This should be the great, I may almost say the only, object of his farm system.

To avoid as much as possible the effects of autumnal rains, winds and frosts, the farmer should plough and sow as early as the weather in the spring will permit. His grain, of whatever description it may be, should be of the earliest and hardiest species ; nor should he hesitate to cut down, although there may be some greens in his field ; if he delays, he has every chance to suffer by shaking, as strong gales are not at all unfrequent in this country in harvest. But the rains in autumn are most prejudicial to the crops in this part of the country. They lodge and prevent them from ripening ; and the only remedy for this is, having the land in good condition, sowing early in spring, and using seed of as early a description as possible. That as little may be left for spring labour as may be, his ploughing should begin immediately after the crop has been secured.

The plan of cropping which I conceive best

suitied for a climate and situation such as this would be—

1st, A green crop, as turnips, potatoes, &c.

2d, Barley or oats, with clover and grass seeds.

3d, Hay, which may either be pastured for a year or two, should it seem proper, or broken up and sown with,

4th, Oats. After which commences a new rotation with some of the green crops, as before. This may be varied according to circumstances; always keeping the attention directed to a supply of winter food.

Besides this mode of cultivation, embracing green crops, another source of supply for winter may be found in the

2. Natural Hay Grounds.—With these, every farm of the district abounds. If the plants be cut before they begin to wither, this hay might prove a very useful, though neither a rich nor a very nutritive species of provender. Coarse grasses of this description, though not relished by the cattle when better can be found, will still be eaten greedily in spring, when food is scarce, even after they have been bleached by the winter rains: how much more, then, had they been secured while yet full of their natural juices! On a Highland farm, where the cattle are often, in a late spring, in the worst condition, such provender would be of great utility. The quantity of

natural hay might be much increased, I apprehend, by irrigation. On Loch Awe, by the overflowings of the lake, Mr Campbell of Comby, and others, have excellent crops of hay; and what they have by the natural overflowings of the water, every farmer here may have by a little labour and expense; the mountains in general affording an abundant supply of water. This part of rural economy was well known to the ancients, as is evident from Homer, lib. 21. and Virgil, georg. 1. Many, and beautiful allusions are made to it also, in the Sacred Writings. Tull, Bakewell, and others, practised it with success: And much valuable information will be found on the subject, in Mr Wright's Treatise on Irrigation; the Agricultural Survey of Wiltshire; and in the Repertory of Arts, Nos. 22. & 49, N. S.

It is a consideration worthy the attention of farmers, not only in this, but in other districts of Scotland, whether the water in which flax has been steeped might not be laid on the land with advantage. The rich oily matter with which it is so strongly impregnated, must certainly be highly fertilizing; while the offensive effluvia which, in its putrid state, it emits, would be avoided. If not used for irrigation, by throwing on earth to absorb it, a rich manure would be obtained, which by the present careless practice is entirely lost. May not the urine of the stable and byre be used advantageously in the same manner?

Connected with this part of the subject, is the

cultivation of Fiorin, which, if the accounts that have been offered to the public should be verified by the experience of this district, would prove by far the most important of all crops as winter pro-
vider. The proprietors will no doubt take the lead in making a fair trial of this hardy plant, said to be so well adapted to the mosses and moors of this part of the country ; and should they be as successful as there is reason to hope they will, the advantages of it to themselves and their tenantry must be incalculable.

3. *Flax and Hemp.*—It is desireable that every country should furnish what its own consump-
tion demands ; and our foreign relations render this a subject more than ever deserving of our attention. Excluded from a great part of the Continents of Europe and America, and conse-
quently deprived of those articles we formerly imported from thence, of which flax and hemp formed a very considerable part, it becomes an important consideration how this want is to be supplied, and whether it may not be supplied at home. That a quantity adequate to our great national consumpt could be raised, appears to me doubtful ; but surely it would be a great object gained, could a quantity be raised equal to the wants of the district itself, for sail-cloth, fishing-
nets, cordage, &c. : And as hemp grows well on a mossy soil, which abounds here, both prop-
rietors and tenants should take this subject into serious consideration. Flax has long been raised

here in small quantities : It should however be increased to such a degree, as to hold a conspicuous place in the husbandry of the district ; for it delights in rather a moist climate. It is, besides, a good preparation for a hay crop ; and both flax and hemp would give employment to a great number of people, in the various stages of their manufacture.

4. *Plantations.*—These both beautify and enrich a country. The mosses which here abound, and the trees occasionally found in them, prove, beyond a doubt, that at some former period, probably very remote, woods were extensive, and the trees of a large size. If, then, this country once abounded in wood, what cause exists to prevent its growth at present ? The first, and I apprehend the principal difficulty, is the want of shelter for the young plants :—give trees shelter, and they will grow almost any where, even in situations most exposed to the sea storm. Lord Galloway's plantations show what a proper system, with management and care, will effect. In all exposed situations, plantations should be of a proper depth ; that the young plants may be a shelter and support to each other, the most hardy being next the storm ; which, though they may arrive at no considerable size,—yet if, under their shelter, others thrive, the advantage gained will be great. This is proved from the plantations of the Earl of Wemyss and March, at Gosford, in

East-Lothian : The trees on the outside are blasted, the moment they attain the height of the wall, except some saugh and birch, which seem to resist the effects of the sea air better than any other kinds ; but the interior of the plantations seems to be thriving exceedingly well. By attention to this, and especially to those kinds of trees which grow naturally on the ground, plantations may be reared, even on the shores of the sea.

In various places of this part of the country, there are stools of natural wood, chiefly birch, interspersed with some valuable spots of oak and ash ; but, in general, the appearance of it is naked. Some patches of wood of this description are on the south-east of Morven. On both sides of Loch Alin, and on both sides of Loch Sunart, there are woods of the same kind, which yield very considerable returns to the proprietors ; indeed, over the whole district, here and there, such woods grow : but as there are few or no enclosures, and no care taken to preserve them, the cattle being allowed free access, they cannot thrive. The most valuable woods in this district are in Ardgour and Lochaber : In the former, above 1000 acres of firs, oak, &c. ; in the latter, above 6000 acres of birch and fir, and not less than 4000 of oak and other species of timber. Upon the shores of Locheil, and the banks of Loch Sheil, there are also considerable quantities of natural wood ; and the gentlemen, with a view

to beauty, convenience, and comfort, are planting around their dwellings timber of various kinds.* In short, there seems nothing to prevent this country from being covered with wood. Oak, fir, birch, ash, mountain ash, holly, elm, and the Scotch poplar, grow naturally everywhere; and in raising plantations, these, on the most exposed situations, as being the natural growth of the country, would better withstand the storm, than those which are strangers to the soil. As a shelter on such grounds, the Pineaster is valuable. This tree has been of the utmost advantage in the Earl of Galloway's plantations. 'The Pineaster is of so much use here, and indeed in such places as are much exposed, as to deserve the greatest attention: It is hardy, and makes vigorous shoots even on the sea beach, and is an excellent defence for other trees.' *Stat. Account of Scotland (parish of Sorbie), Vol. I. p. 124.*

But whether plantations may or may not be raised on the coast, the interior parts of the country afford ample scope for the planter. To accomplish this, the stools of natural wood evince the difficulty to be small indeed.

Previous to planting, if the soil be wet, it

* Along the shores of the Linnhe Loch, considerable patches of natural wood grow also; but Ardnamurchan, and the other parts to the north of it, are almost naked.

must be at least surface-drained, and completely fenced from sheep and cattle : If this be not done, it would be in vain to expect a thriving wood ; nothing being more detrimental to the growth of young plantations than the rubbing and browsing of cattle, and especially of sheep. If these things be attended to, there can be little doubt of plantations thriving here ; and, with truth it may be asserted, that in a very few years they will reimburse the planter of his outlay—be to him a source of annual revenue—and at last become the most valuable portion of his whole estate. A valuable paper on this subject, by the Rev. Mr Hamilton of Ashkirk, may be found in the Transactions of the Bath, &c. Society.

By the green-crop system, then, and by the other means proposed, it appears to me that this district may be greatly improved, and rendered vastly more productive, both to proprietors and possessors, and to the community at large.

III. ADVANTAGES AND DISADVANTAGES.

1st, With regard to its *Advantages*.

1. One important advantage enjoyed by this district, is evidently the *great extent of its sea coast*, the cause of its mild open winters. This affords an easy communication, and cheap conveyance, to distant places. Besides, the vast numbers of

excellent fish found upon the coast, ought to be accounted a very great blessing.

Fish of various kinds, and of excellent quality, are to be found on these coasts at all seasons of the year ;—cod, ling, haddock, whiting, mackerel, flounder, &c. with a variety of shell-fish, as oysters, cockles, crabs, muscles, &c. The fishing of these, with industry and application, might be productive of immense advantage. On every part of this coast, the White fishing, as it is called, might be prosecuted to a great extent. To instruct the people in the management of the lines, with the most proper mode of conducting it, it might be found beneficial to bring some fishermen from Orkney, the east-coast of Scotland, or from Holland, could such be obtained.

Herrings usually frequent the coasts here, from July to November. Although none of the great fishing stations are in this district, yet some one or other of the lochs, with which it is indented, have an annual visit from the herrings ; and many of the inhabitants go every year to Loch Hourn, or some of the lochs farther to the north, to prosecute this useful trade ; but from a want of capital, they are unable to prosecute it to any extent ; and hitherto it has been mostly in the hands of strangers, chiefly the Clyde merchants. It is to be hoped that the proprietors, perceiving the advantage to be derived from this fishery, will assist in providing what is necessary ; and this I know some proprietors of the west coast of Inverness,

shire mean to do; whose laudable example will, I trust, be followed by others. To conduct this business, some regulations as to the time, manner, &c. seem necessary to ensure success; at present, every one does 'what seems right in 'his own eyes:' And, whenever the herrings appear, which is known by the great numbers of fish and fowls which attend them, all the boats are on the alert; some are shooting, some drawing their nets; others crossing in all directions. In consequence, the greatest bustle and confusion arise; the herrings are frightened, prevented from settling, or perhaps compelled to shift their ground, or depart altogether. The truth of this was abundantly proved by what occurred on Loch Hourn this last season, where there was a great promise of a good fishing at one time; but a conduct something similar to what is stated above, was the occasion of a very great falling off. This calls loudly for some regulation, and the appointment of a proper person to act as superintendent or admiral of the herring fleet, with full power and authority to punish transgressors. Small premiums might also be of use as a stimulus. It may fairly be questioned, whether the bounty given by Government was, upon the whole, an advantage;—certainly only to a small number of the inhabitants;—as, either from want of capital, or some other cause, few of them engaged in it;—and it has been almost wholly in the hands of the merchants on the Clyde.

The various fisheries, which on this coast might be prosecuted to a great extent, would furnish many of the people, for a considerable part of the year, with useful employment, in making the hemp into yarn, weaving the nets and sail-cloth, and in the other branches which this trade requires.

The curing of red herrings might be conducted here with success: As the juniper shrub abounds, might not the flavour it gives to hams, and for which they are so much esteemed, be also communicated to herrings? and might not iceing succeed, as well with herring, &c. as with salmon? Salmon grilse, and sea trout, are in plenty, and of the finest kind, at the mouths of all the rivers: There is a very good salmon fishery at the head of Loch Alin in Morven; in Ard-gour, and various other parts of this district: But the principal salmon fishery is upon the Lochy, which yields a very great rent to its noble proprietor, his Grace the Duke of Gordon.

Although the sea be the great storehouse of fish, the fresh waters must not be despised. A number of lakes, some of them of great extent, and most of them well stocked with fish, are found in this district. Loch Archaig on the northern boundary, is not less than 16 miles in length, and one in breadth. Loch Sheil, which crosses the country from Locheil to Loch Moildart, is still of greater extent. Loch Conich and Loch Beg in Morven, with many others, either

abound with fish, as trout, char, &c.; or might be stocked, where deficient, with those and other fresh water fish; furnishing a comfortable and wholesome food, and compensating the inhabitants in some measure for their want of sea coast. In this way, we learn from history, the people of Switzerland, from their rivers and their lakes, derived much wholesome and nutritious food.

If we are to judge of fishing villages (so highly extolled by some) from those already erected, our judgment would certainly not be favourable; most of them being little else than nests of vice and immorality. It would be better to encourage the trade first; villages and other accommodations would follow of course; always supposing every facility to be granted by landed proprietors, when required, for the accommodation of the people. A mournful picture of the state of morals in some of the Highland fishing villages, is drawn by Sir G. Mackenzie, in his Survey of the county of Ross.—In Far. Mag. Vol. XI. p. 296, *et seqq.* we have a very valuable communication on the Fisheries.

Another advantage derived from the sea, is the quantity of sea-ware, from which, in the making of kelp, some thousand pounds are brought into the district; and by attention to encourage the growth of the plants, this quantity might be greatly increased. This also affords a great deal of most excellent manure; which, together with banks of shell sand, in quality little, if at all, inferior to

Lime, found in many places on the coasts of this district, form a source of profit, of which the extent cannot well be estimated.

2. *Lime*.—Abundance of this is found in Kilmalie parish; in Ardgour; in various parts of Morven, especially at the head of Loch Alin, and in other places. The island of Lismore, on the south-east of Morven, is one bed of lime rock; and as it can be water-borne to almost every place here, the expense of carriage is trifling: the only drawback is the scarcity of coal for burning. It is found, however, that peat answers equally well; only requiring the stones to be broken smaller, and more equally laid on the kiln,

3. *Clay, Stone, and Shell Marls* — are here found in many of the mosses; and industry might possibly find many more: And if composts on Lord Meadowbank's plan were in general use, the materials for which are plentiful, as moss, lime, dung, to which sea-ware may be added, the farmer might have manure almost in any quantity he pleased.

4. *Minerals*.—*Coal* is found at the head of Loch Alin, but has never been worked; as has been the case with that in the adjacent island of Mull. An attempt to work *Lead*, at Lurgbhuid in Moryen, was made, but without success. This

mineral has long been worked at Strontian, in Sunart: For some time back it has been rather declining; but it was expected, that on completing a water level, richer veins of the metal would be got at, and the mine be made productive. In these mines, that species of *Terra ponderosa*, called *Strontites*, is found, having chemical qualities peculiar to itself. Fine specimens of *Asbestus*, and *talc*, studded with garnets, are found in the hills in this neighbourhood. *Lead veins* have been discovered also at Inverscaddle, in Ardgour, on the Fassfern estate; and in the adjacent mountain of Benevis. *Freestone* is found in many places. Rocks of a beautiful red granite, susceptible of a bright polish, not inferior in appearance to marble, are seen at Salachan, in Ardgour; and at Balachelish, on the opposite shore of Loch Leven. *Slate*, of an excellent quality, is wrought and exported to a considerable extent. Here are also *Iron ores* and *Plumbago*. *Copper* was once wrought at Invergarvey, in the neighbourhood of the northern boundary of the district. On many of the rivers, and particularly on the Lochy, there are excellent stations for machinery, and an abundant supply of water at all seasons of the year. For an account of the minerals of this district and the neighbourhood, *vid.* Edinburgh Encyclopædia, article Argyleshire,—and Williams's History of the Mineral Kingdom.

2d, DISADVANTAGES.

1. *Want of Roads.*—One of the most important branches of rural economy, is certainly good roads. It has often been observed, that the progress of agriculture may be known from the farmer's accommodations; and the state of the roads is a criterion not less certain. If these be bad, it may be inferred that the state of agriculture is low. In no part are good roads and bridges more necessary than here; the torrents descend from the hills with such rapidity, as in a short time to render it almost absolutely impossible to cross over till they again subside. It must be acknowledged, however, a good deal has already been done to remedy this defect, and still more is in contemplation; but a great part of this country has almost no roads. Morven, Ardnamurchan, Moran, &c. have nothing but country roads, often hardly passable.

(1.) One of the best roads in this district, is the Loch-Moidart road, from Corran Ferry in Ard-gour, passing southward on the west side of Linnhe Loch * to Inversanda; from thence it crosses the country westward to the head of Loch Sunart, going along its northern shore by Stron-

* From Inversanda, a new line is intended across Morven to the Sound of Mull, about 20 miles in length.

tian, Ronachan, Reisipoll, Saline ; from this a branch goes off to the north to Moidart. From Saline, in a south-west direction, it goes to Glenmore ferry, opposite to Isle Oransay, near the mouth of Loch Sunart, an extent of not less than 34 miles.

(2.) Lochna-Gaul road, from Arisaig on the side of Lochna-Gaul, and by the north shore of Locheil to the ferry over the Lochy near Fort-William, a length of about 37 miles ; and a very good road.

(3.) Lochy-side road, from Corpach along the west of the river Lochy, to Cluny ; with a branch from this towards Loch Archaig, above 12 miles in length ; a most complete, excellent road.

(4.) Archeg road, from Loch Nevish by Glendessary, and the north side of Loch Archaig, to Auchnacarrie, near which it joins the Lochy-side road ; in length above 20 miles.

These are the principal roads of this district. The others in contemplation will, when accomplished, be of vast advantage : And much praise is due to many public spirited gentlemen for their attention to this very essential branch of rural economy.

2. *Want of Enclosures.*—These are indispensably necessary to successful farming. I am inclined to think the thorn would succeed well in the low grounds, and would be useful, not only as a fence, but as affording shelter. Stone walls,

however, are considered the only fence, either eligible or profitable. Earthen dikes, planted on the top with furze, are recommended by some ; but the dissemination of the seeds, and consequently of the plants, may be one reason why this plan is not likely to be generally adopted.

3. *Fuel.*—Peat is generally used for this purpose ; but the time and labour, especially in wet seasons, attending the making and saving of peats, interferes very much with the other labours of the farm, particularly the hay harvest. Most of the better sort burn coal in part, which they import from Liverpool ; but the situation of the inhabitants of the interior, and the poverty of many on the coast, oblige them to use peat, with all its disadvantages. The only remedy for this, perhaps, is plantations, which would adorn and beautify the country ; and, in time, afford abundance of excellent fuel.

4. *Distance from Markets.*—In vending the articles which the people have to dispose of, in consequence of this disadvantage, they have to treat with those who travel the country ; and, as the competition is small, they are often obliged to sell their commodities at an undervalue. This may easily be remedied, by the establishment of regular markets, at proper seasons and places ; where, by exciting a competition, a fair price may be obtained.

5. Climate.—In an agricultural view, this is the greatest disadvantage. Lands may be drained, woods may be planted, comfortable houses built; —by various ways the conveniences of life may be augmented ;—but no human power can diminish the quantity of rain, or abate the violence of storms. These are peculiarly unfavourable to grain, and are not unfrequent in the harvest season in this country ;—a reason why most of the farmers here find it their interest to have as much as possible of their land in pasture.

Having thus stated some of the advantages and disadvantages connected with this district, what now remains is, to make some remarks on

IV. ITS MANUFACTURES.

This country affords materials for various kinds of these, which would be a vast source of wealth, besides giving employment to many of the inhabitants. The first I shall mention is

1. Iron.—A work of this kind has been long established in Upper Lorn, and another on Lochfyne, below Inverary, by English companies, chiefly for the sake of the charcoal which the woods afford; for the ore is carried from England, and made into blooms. In various parts of this district, iron ore abounds; and, as already mentioned, many stools of natural wood, for the manufacture of this article.

2. Linen.—This manufacture would be highly advantageous. Every encouragement should be given to the growth of flax, for which the soil and climate are so well suited. Till this is done, agents should be employed to distribute imported flax to the women for spinning, as is done in other places. Athol has been long famous for its yarn. To make this district equally so, the same inducements are only necessary to be held out to the people. In this manufacture, nothing but coarse linens, suitable to the immediate wants of the district, should be attempted at first. For every part of the process, from the sowing of the seed to the finishing of the cloth, this country is well adapted. The bleaching, and other processes connected therewith, may here be conducted in the most perfect manner, the water being plentiful, and perfectly limpid and pure.

3. Wool.—If the exportation of raw materials be always considered by nations as highly disadvantageous, is it not to be regretted that so much wool should be annually sent out of this and the adjacent districts to Liverpool, and other English ports, whence it is often returned after being wrought into cloth; whereby the manufacturers in the South are enriched, while the population at home are idle and poor? From the port of Fort-William alone, the export is from 10,000 to 15,000 stones annually; and as sheep are increasing, the quantity of wool must also increase.

The late worthy and patriotic Duke of Argyll, erected a woollen manufactory near Inverary : Coarse cloths only, such as serges, plaidens, &c. should be tried at the beginning, till experience and capital prepare them for engaging in the finer kinds. The spinning and carding, not to mention the other branches connected with it, would give employment to many. Perhaps tanneries might also be conducted here with advantage. A saw-mill was formerly erected on the river Archaig, but without success.

The most proper place for these manufactories seems to be somewhere on the banks of the Lochy, from whence, after the completion of the Caledonian Canal, the carriage will be easy, to the east as well as the west. At the same time it might be proper for the proprietors, to encourage them on their respective estates. It was on the Lochy the late benevolent Mr Dale proposed erecting a cotton-mill, which failed of success from want of water carriage :—the Caledonian Canal was not then begun. This country affords abundance of materials for the various buildings,—stone, slate, wood, and water. It would be an advantage to this district, if a ~~canal~~ was cut between Locheil and Loch Sheil, a distance of three or four miles of soft moss ; and from Loch Sheil there is a river of a mile in length. Sailors would, by means of this, avoid the stormy point of Ardnamurchan, and the other dangers of that navigation.

Having thus stated, shortly, what I conceive best calculated for improving this district of the Highlands, I conclude, with earnestly requesting the different proprietors, by all rational means, to encourage the measures I have ventured to recommend, or such others as may be thought better adapted to promote this highly important object.



A C C O U N T

or

STOCK SOILED ON CLOVER,

ON THE

FARM OF PITMURTHLY, IN THE PARISH OF REDGORTON,
AND COUNTY OF PERTH, IN 1812.

15 Milch cows, average weight about 29
stones.

1 Bull.

1 Farrow cow, } three weeks at
5 Two-year old queys, } pasture.

1 Milch cow added 19th August.

—
23 Cattle.

No. 1. 7 Work horses.

2. 1 Do. till 15th July, then sold.
3. 1 Mare and foal, three weeks at pasture.
4. 1 Two-year old working filly.
5. 1 Saddle horse.
6. 1 Galloway.

—
12 Horses.

1 Ass—1 Mule.

No. 7. 4 One-year old colts, from 10th August
to 6th September.

12 Swine, kept chiefly on clover, with the
addition of offals from the garden
and kitchen.

The work-horses were fed constantly in the
stable, on cut clover only.

The horses Nos. 4, 5, & 6. were turned out in
the homestead in the day-time, when not at work,
and when the weather was good; and stabled at
night.

Nos. 3. & 7. were at large in the homestead
night and day. A large wooden crib was placed
out of doors, which was regularly supplied with
cut clover for the use of the above, and of such
other bestial as had the range of the homestead,
including 8 calves.

The 5 queys, the farrow cow, the ass and mule,
were kept in the straw-yard on cut clover, and
the offals of the stable.—A watering-trough in the
yard, supplied from the pump.

The milch-cows were served with clover in the
byres at least three times a day, viz. early in the
morning, at mid-day, and at night. They were
turned out twice a day in the homestead, viz. af-
ter milking in the morning and afternoon.

The homestead contains about eleven acres of
pasture, and is the only addition that was used in
aid of the soiling, besides the exceptions noted in

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the list of the stock. It was eaten completely bare before the clover was fit for cutting ; and consequently, the beasts derived very little benefit from it, except exercise and watering. The milch-cows, in particular, frequently would not take a single bite, especially in hot weather, but sought admission into the byres ; which, in such cases, was immediately granted, and an extra supply of clover served to them.

The duration of the soiling this season, or, rather, the period during which it was in full operation, was about three months, viz. from the middle of June to the middle of September. This was shorter than usual, owing partly to the backwardness of vegetation in the spring and beginning of summer, but chiefly to an almost general deficiency, in this quarter, of the second crop of clover after hay, insomuch, that I did not obtain above a week's full supply for soiling from upwards of twenty acres of aftermath, and consequently was obliged to pasture it. But in ordinary seasons, the second crop after hay generally yields a full supply for soiling, till such time as the frost renders it unfit for that purpose.

Before exhibiting an account of the clover consumed, with my opinion respecting the profit and advantages derived from soiling, I judge it proper to give a short description of my farm, and some part of my management, in order both to assist the Society in forming an opinion as to the practice of soiling, and to enable them better to

Judge of my claim as a competitor for the premium.

The farm contains 182 Scots acres, held on a nineteen years lease, which expires in 1816. It is four miles north from Perth, considerably elevated above the site of that town. At the commencement of the present lease, it consisted of about 70 acres of middling good croft land, the remainder being outfield and unimproved moor, chiefly of a poor, cold, wettish soil; the whole in a very foul and impoverished state. It was all improved, and got a dressing of lime and dung during the first eight years of the lease. The greater part of the land being considered ill adapted for pasture, and having a command of manure from Perth, and likewise a supply of moss on the farm, the following mode of cropping was adopted, and, in general, strictly adhered to, viz.

1. Oats after grass.
2. Fallow, or drilled green crop, dunged.
3. Wheat, oats, or barley.
4. Clover and rye-grass.

From this view of the farm it will be evident, that, with the above rotation, it would not be possible for the tenant to keep a stock, of the extent and description above mentioned, on the farm alone, without soiling. In prosecuting the plan to advantage, there are two obstacles, which are the more serious, if, as in my case, the dairy be made a leading object. The first is, the difficulty of providing a supply of juicy and nutriti-

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ous food for the latter part of spring and beginning of summer, till the grass come fully into action. The next is, in ensuring a succession of fresh herbage for the summer and autumn.

For some years back, I have accomplished the first of these objects, by raising four to six acres of Swedish turnips; and, when they succeed, which with proper attention they generally do, I am enabled to keep my milch-cows in high condition till they get a full bite of the grass;—sometimes, with an extra good crop, even till the clover be fit for cutting. The general method of surmounting the other difficulty, is by sowing tares, to come in between the first and second cutting of clover. This was my practice for some years; but I found tares rather a precarious crop on my soil; and at times the seed was not to be obtained but at an extravagant price. This put me upon trying a very simple experiment, which has fully succeeded, and enables me to dispense with tares entirely. I allow my milch-cows to pasture a portion of my young clover so soon as it comes to a middling bite. I next begin cutting the best and most forward of my clover, so soon as the scythe can lay hold of it. The space that has been pastured is ready for cutting by the time the first crop begins to get hard and dry. By the time the former is exhausted, a second crop is ready, where it was first mowed; and this last is succeeded by the second crop after hay. By a little attention to these particulars, I have ge-

nerally a regular succession of fresh, juicy clover, throughout the season; and the apparent waste incurred by pasturing the young clover, I consider is fully compensated by its beneficial effects on the milch-cows, or any other favourite stock. The following are the advantages which I conceive I derive from soiling, under all the above mentioned circumstances.

1st, Keeping a large and profitable stock of bestial, at a comparatively small expense.

2d, An extra supply of rich manure.

3d, Pasturage, on a farm generally ill adapted for it, is dispensed with.

4th, Having one half of the farm in white crop, thereby yielding a better return, and more ample means for the reproduction of manure. Which leads,

5th, To the land being kept clean and in good heart, under an apparently severe mode of cropping, by introducing a fallow or drilled green crop every fourth year, accompanied with a good dunging.

In the course of my practice, the following objections have occurred to part of my plan. I have said above, that the greater part of my farm is of a cold, wetish soil; and it has sometimes happened, in wet seasons, that I could not, with every exertion, get my turnip break thoroughly cleaned, and likewise had a very deficient crop. It is obvious that, with only four years of my lease to run, I could not alter my rotation. But

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were I entering on a new lease, I would adopt the following :—1. Oats after clover ; 2. Clean fallow ; 3. Wheat, or Oats ; 4. Turnips and Potatoes; 5. Barley; 6. Clover. This rotation would enable me, almost to a certainty, to keep the land perfectly clean : It would render the preparation of the turnip and potatoe break a much easier process ; consequently these important crops would be less dependent on the vicissitudes of weather : And, lastly, it would be much in favour of the clover crop, which I have uniformly found to answer better after barley than after wheat or oats. It would be scarcely possible to afford a full dunging, both to the bare fallow and the green crop, that is, every fourth and sixth year. That, however, would fall to be regulated by circumstances. In the case of the bare fallow getting a full dose for a wheat crop, the turnips might do without any, or with a small allowance. If the bare fallow were to be followed by a crop of oats, the whole dung might be applied to the green crop, or it might be divided between them according to circumstances. In regard to the failure of the turnip crop ; as no mode of management, though conducted with the utmost care and skill, can effectually prevent it at all times, I have only to mention the substitute I recur to when it happens with me, which was the case last year. When the turnips were exhausted, which was about the end of March, I allowed such cows as were giving milk a feed of steeped

chaff, mixed with oil-dust twice a day, varying the rate according to the state of the cows ; that is, giving the new calved cows the largest allowance, and the others in proportion. This, I found, both put the cows in fine condition, and prevented the milk from falling off till the grass came in. The oil-dust began at 20d., and left off at 2s. per stone. The whole outlay for it was 7*l.* 5*s.* I had intended last spring to give my cows steamed potatoes when the turnips should fail, and got a steaming apparatus erected for the purpose ; but the potatoes became so valuable, I laid it aside for the time. Having a large crop of turnips this season, I shall not require any thing in lieu of them for my cows ; but I mean to steam potatoes for my horses, which I think will enable me to keep them without oats, at least till the middle of March.

I now proceed to give the account of the clover consumed, in which I am sorry I have it not in my power to report *the weight*, as it was the middle of August, before I thought of becoming a competitor for the premium ; and by that time the most important part of the soiling season was past. I have, however, made an estimate of what the ground would have produced *in hay*, which is, I think, pretty correct, and will, I hope, be equally satisfactory to the Society.

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**Account of Clover used in Soiling in Summer
and Autumn 1812.**

A. R. P.	Estimated Pro- duce in Hay.
1 0 20 croft land, pastured, and afterwards cut - -	180 stones.
6 2 0 outfield land do. do.	840 —
4 1 5 croft land, twice cut -	760 —
<hr/> 11 3 25	1780 stones.

The general view of my practice here given, in addition to the account of my soiling, will, I hope, in some degree, assist the Society in estimating the advantages attending that branch of rural economy. In regard to the direct profit arising from it, it is to be observed, that some of my statements are not susceptible of being brought to the test of calculation; at least I must confess I am not equal to the task.

Supposing that I were to keep my present stock of bestial at pasture in place of soiling, with my farm under either of the rotations above described; and having it in my power to rent pasture land in a situation every way convenient for my stock, such as I have described it, the following may, I think, be taken as a fair view of the matter.

To 52 acres pasture, rented for the season at 3 <i>l</i> . per acre - - -	L.156 0 0
By 1780 stones hay saved, at 1 <i>s</i> . - -	89 0 0
Loss -	L.67 0 0

—exclusive of the dung taken off the farm.

Another view of the subject may be taken, by comparing the rotation I proposed to adopt, as mentioned in page 536th, with one which would embrace such a proportion of pasture as might be adequate to the maintenance of the stock without soiling.

171 Acres in tillage, the homestead being in permanent pasture.

1st,

28½ acres oats, - - -	at 10 <i>l.</i> p.acre	L.285	0	0
28½ — fallow - - -				
28½ — wheat or oats, - -	12 <i>l.</i>	—	342	0 0
28½ — turnips and potatoes, 11 <i>l.</i>	—		313	10 0
28½ — barley, - - -	10 <i>l.</i>	—	285	0 0
28½ — hay, - - -	7 <i>l.</i>	—	199	10 0
<hr/>				
A. 171		L.1425	0	0
<hr/>				

2d,

19 acres oats, - - -	at 10 <i>l.</i> p.acre	L.190	0	0
19 — fallow, - - -				
19 — wheat or oats, - -	12 <i>l.</i>	—	228	0 0
19 — turnips and potatoes, 11 <i>l.</i>	—		209	0 0
19 — barley, - - -	10 <i>l.</i>	—	190	0 0
19 — hay, - - -	7 <i>l.</i>	—	133	0 0
19				
19 } 57 acres pasture, - -	8 <i>l.</i>	—	171	0 0
19				

A. 171		L.1121	0	0
Add a man and pair of horses saved	-	120	0	0
		L.1241	0	0
Iude—Loss by this rotation	-	184	0	0
		L.1425	0	0

540. ACCOUNT OF STOCK SOILED ON CLOVER

Kinvaid, 26th November, 1812.

I hereby certify, that the foregoing statement made by James Caw Esq., residing at Pitmurthly, of his mode of soiling his horses and cattle, is, to my knowledge, very justly and candidly stated : And this I am enabled to do, having occasion to see his farm and bestial frequently, being near neighbours.

It likewise consists with my knowledge, that Mr Caw, from his attention and good management, has always as good crops of all kinds as any in this district ; and that his horses and cattle are always in high condition. Were it necessary to say any thing regarding Mr Caw's own character in support of the above report, I should feel myself highly gratified in testifying how much his integrity and deportment are respected over all this neighbourhood, as well as by those who have the pleasure of his acquaintance.

JAMES STEWART, J. P.

Redgorton, 26th November, 1812.

After so full a testimony from so respectable a hand as Mr Stewart of Kinvaid, it is only necessary for me to add, that I concur with his statement in every respect. But I cannot help farther remarking, that Mr Caw has this season on his farm about five acres of the best Swedish turnips I have any where seen.

WILLIAM LISTON, Minister.

Edinburgh, 29th November, 1812.

I have occasion to know the farm occupied by Mr Caw, which is on the estate of Sir Thomas Graham, and at no great distance from my father's residence; and I concur with the preceding report of Mr Stewart and Mr Liston.

AND^w. MURRAY,
Member of the H. Society.

R E P O R T
OF THE
BEST MANAGED FARMS IN KINTYRE.

By a COMMITTEE of the HIGHLAND SOCIETY.

CAMPBELLTOWN, 10th Nov. 1812.

THE adjourned meeting of the Committee of Members of the Highland Society, residing in the district of Kintyre, having taken place this day according to appointment, to report to the Society the farms within the district in their opinion entitled to the premiums offered in their advertisement, there were present—

Colonel MATTHEW M'ALISTER of Rosshill,
CHARLES MACVICAR Esq. of Killellan.

ARCHIBALD BUCHANAN Esq. of Torry. And
JOHN CAMPBELL of Stonefield, *Convener.*

The Convener produced letters from Duncan Stewart Esq. of Glenbuckie, and David S. Galbreath Esq. of Lochsanish, containing their opinions: And the meeting, after full consideration of the respective merits of the farms entering into the competition, six in number, recommends Mr James Lang, tenant of Tonreoch, for the first premium, and Mr Lachlan M'Eachen, tenant of Ardnacross, for the second. The particulars of the management of these two farms are contained in the accompanying Reports.

The Meeting begs leave to state its high opinion of the spirit and judgment with which Mr

Lang has conducted his improvements. In a country where agriculture is yet in its infancy, his example cannot fail of being of the greatest advantage. Great praise is also due to Mr M'Eachen for the judgment and industry with which he has improved a considerable quantity of very wet, stony high ground, formerly of little value, and for the general good order of his farm.

The Meeting remarked, with pleasure, the strong stimulus which the liberality of the Highland Society has given to agricultural improvement in this district, which has been strikingly manifested by the exertions made since last season on all the farms inspected.

Besides the six farms inspected by the Committee, the farms of Skipness and Drumlembie were named: But their claims were thought inadmissible; the former farm being rented by a son of the proprietor's; and the latter by a company, of which the proprietor is a partner: But the Meeting beg leave to transmit Mr Robert Campbell of Skipness's Report * with the other two, on account of the high state of cultivation to which this farm has been brought.

JOHN CAMPBELL, Convener.

M. MACALISTER.

C. M'VICAR.

ARCHD. BUCHANAN.

* Mr Campbell's Report was lodged with a member of the Committee of the Society; but it has not been returned with the other Reports: And Mr Campbell having destroyed some of the papers on which his Report was founded, could not furnish a copy of it. E.

REPORT by JAMES LANG, Tackman of the Farm of Tonioch in Kintyre, belonging to his Grace the Duke of ARGYLE, of the Management of said Farm, for the Years 1810, 1811, 1812 : Which consists of 140 acres.—Rent £80/- Sterling yearly.

Number of Enclosures.	Acres.	Crops 1810.		Crops 1811.		Crops 1812.		Average Crops for the last three Years.
		Crops 1810.	Crops 1811.	Crops 1811.	Crops 1812.	Crops 1812.	Crops 1812.	
1.	11	Bear.	Hay. & Turnips and Beans.	Oats.	Oats.	Wheat, per acre, 45 Winchester bushels.		
2.	15	Oats and Bar.		Bear, sown down with Grass.		Bear, per ditto, 52 ditto.		
3.	11 <i>1</i>	Pasture.	Oats.	Pasture.		Oats, per ditto, 56 ditto.		
4.	11	Oats.	Fallow.	Oats.		Beans, per ditto, 26 ditto.		
5.	18 <i>1</i>	Oats.	Pasture.	Pasture.		Potatoes, 30 bushels per acre, each bushel weighing 800 lb.		
6.	8	Moss pasture.	Moss pasture.	Moss pasture.		Hay, 200 to 250 stones per acre.		
7.	5 <i>1</i>	Ditto do.	Ditto do.	Ditto do.		16 head of large Cattle have been fattened annually on the turnip crop; besides a considerable quantity given to the milch cows and young cattle.		
8.	5	Pasture.	Oats.	Oats.		Moss pasture.		
9.	5	Fallow.	Oats.	Oats.		Ditto do.		
10.	7	Turnips.	Bear.	Hay.		Meadow Hay.		
11.	9	Hay.	Oats.	Oats.		Oats.		
12.	3	Pasture.	Pasture.	Pasture.		Beans, & Beans.		
13.	5 <i>1</i>	Potatoes and Beans.	Wheat and Beans.	Wheat and Beans.		Beans and Hay.		
14.	8 <i>1</i>	Potatoes and Beans.	Wheat and Oats.	Wheat and Oats.		Beans and Fallow.		
15.	6 <i>1</i>	Hay.	Wheat and Oats.	Wheat and Oats.		Potatoes.		
16.	6 <i>1</i>	Wheat.	Oats.	Oats.		Turnips.		
17.	6 <i>1</i>	Wheat.	Potatoes.	Potatoes.		Wheat.		

To JOHN CAMERON, Esq. of Stonfield, &c. &c. Convenor of the Committee of the Highland Society for the district of Kintyre.

James Lang.

[To face page 544.]

**REPORT of the Farm of Ardnacross, belonging
to Major HECTC There is about 160 acres un-
der cultivation,**

In the year 1801, I got pter building new, and repairing old state, without march dikes, or, building march dikes, draining, en- in a bad state, the arable land, subdividing, and clearing the differ- weeds and stones, &c. fields of rocks and stones, which have

After going over the whole carried to the dikes and drains, I go on crop, (potatoes, turnip and f crops, viz.—First year a green crop, outfield (high ground that pear, with clover and ryegrass ; 3d year, the said crops. In the year ; 5th year, Beans. But if the soil is draining, planted with potato and 5th years ; and the 6th year, Oats : 20 acres of outfield and bog, draining and clearing of stones mostly harrowed in with the st year after ploughing from lea, Oats, was early oats, white clover, little lime ; 2d year, Oats ; 3d year, I had 6 acres of outfield and peat or turnip ; 4th year, Early oats, wise this year, 1811, I have 8clover, and grass seeds for pasture. clover, and grass seed, for p

Since I got possession of produce per acre for the three years.— ed drains, from $2\frac{1}{2}$ to 6 feet 40 bushels ; Beans, 23 bushels ; Pota- ditches. 0 to 260 stones.—45 Acres have been

This farm has been under been manured ; besides a great quantity crops this season, viz. ed on the clover-lea during the three been kept on the farm annually, and

Under a crop of	O	turnip, during winter : the return from
Ditto ditto	B	Beeling. From 20 to 24 Calves are reared
Ditto ditto	B	But two year old, sold at from 5l. to 6l.
Ditto ditto	P	
Ditto ditto	T	
Ditto ditto	H	The returns cannot be equally good from
Ditto ditto	W	W More than the half of this farm is of
Ditto ditto	P	Peat part of the potato crops has been
	d	d, to improve it, and bring it to a pro-
	n	nown to the gentlemen of the district,
	h	h who inspected the farm.

Five or six acres sowing at

LAUCHLAN MACEACHEN.

the opposition of one person. Last summer a part of the proposed drain was finished, being all that lies higher than this person's ground: and now he refuses to deepen the outlet; so that a part of the drain is useless. A process is at present going on before the Sheriff of Dunfermline, to oblige him to make the march not only a fence, but a drain; but the Sheriff has not power, as the law now stands, to do this. The drain made this summer is 2950 yards in length, 20 feet wide at top, 6 feet wide at bottom, and 6 feet deep. The earth dug from it is carried to the distance of from 20 to 36 feet from the brink of the drain. It will enable the proprietors to lay dry a great deal of ground, some of which will be in oats this year. The existence of this drain is owing principally to my neighbour Mr. Young of Cleish.

I shall mention another instance still nearer me. On the banks of the river Gairny, there is a tract of wet ground, nearly three miles in length, and about three furlongs in breadth; one half of which is in this parish. It could be easily drained, as it lies upon open gravel, with a regular fall of more than seven feet to the mile. In this tract there is much valuable land, some of which is cultivated, and some beginning to be improved, but none completely drained. Two years ago, I proposed to the proprietors to enter into a submission, in order to have the course of the river deepened, each one to pay according to the advantage received, and the Sheriff to appoint the

persons who were to value the ground, and carry on the work. This plan failed principally through the opposition of one man. One instance will show what nearly the worst of this ground could be brought to. Mr Burt of Barns has a bog of thirty acres, which, when enclosed and sheltered with planting, was let a few years ago in pasture for 9*l*. He divided it into three fields of ten acres each; drained it as well as the level would admit, and deepened as much as he could the course of the river. The crop of the first ten acres was sold for 80*l*.; and that field is now worth 15*l.* a year in pasture. The second field produced oats last year worth 60*l.*: the third field will be in crop this year. As the law stands at present, there is little chance of any of this wet ground being completely drained.

I shall now mention an instance of a different kind. My next neighbour has about half an acre of ground near his house, which he keeps mostly in garden cultivation, beside his ordinary garden. It is not sufficiently drained, though it could easily be done; for there is fall sufficient within a few yards; but this fall is in another man's ground. A draining act would not be complete, unless it would apply to such cases as this, many of which occur; but if draining and enclosing were put upon the same footing, the matter would be easy. I know several places in the Carse of Gowry, in the neighbourhood of Stirling and elsewhere, which would be much benefited by a draining

act. In the small county of Kinross, there are a great many ; and, in this parish, I can point out at least twenty places, where the proprietors have it in their power, if not entirely to prevent, at least greatly to obstruct, and to render imperfect, the draining of their neighbours' grounds.

I shall only mention another case, with which I am partly acquainted. On the estate of Balgowan in Perthshire, and to the eastward and westward of it, there was a bog of great extent. An act of Parliament was got for draining it, more than a hundred years ago. A drain was made three or four miles in length ; but, by a strange mistake, though the act empowered the proprietors to make the drain, it did not empower them to clean it. It sometimes has remained uncleansed for twenty years, till the effect of it was almost lost, and the floods did great damage to the crops of the neighbouring farmers. If this had been a march fence, how easily could the Sheriff have settled the matter !

Perhaps, in a draining act for Scotland, scarcely any detail would be necessary. If Parliament were merely to fill up the blank which at present exists in our good old acts, leaving it to our own judges to regulate what relates to draining, as they have done what relates to the other improvements of land, this would be sufficient. And if this were to be done early during the present session, many a labourer would be immediately set to work, and many an additional acre of oats would be raised before the end of another year.

PROCEEDINGS
OF THE
HIGHLAND SOCIETY OF SCOTLAND,
RESPECTING THE
GRUBBER, OR SCARIFIER.*

MEETING OF DIRECTORS,—9th March 1814,

The Earl of WEMYSS in the Chair.

“ SIR JOHN SINCLAIR called the attention of the Directors to an implement of husbandry, very general in England, called a Scarifier, (known also by various other denominations), and which, under the name of *Grubber*, had recently been introduced, with success, in East Lothian, by several respectable agriculturists. This implement promised to be very useful in late seasons, or in land which had already received one or two fur-

* It is proper to state the distinction between scarifiers and scufflers. *The scuffer* is an instrument with flat triangular cutters, merely to cut the weeds, and they are afterwards raked up by harrows. *The scarifier*, on the other hand, has bent coulters; tears up the couch, and other root weeds, and brings them to the surface.

rows, as it would probably supersede the necessity of an additional ploughing.

“ The Directors, upon the motion of Sir John Sinclair, resolved, That Mr Gray, maker of agricultural implements, be directed to repair to East Lothian,—to examine this machine,—and to take a drawing of it,—and, after ascertaining the sentiments of such farmers there as had used it, to report his opinion and observations thereupon, with a drawing of the machine, to the Standing Committee of the Society on Machinery ; and, in the event of the report being favourable, the Committee is authorized to take such steps, for recommending the bringing of this implement into more general use, as may appear expedient.” *

* A very favourable Report, founded on the experience of several eminent farmers in East Lothian, having been accordingly laid before the Committee on Machinery, Mr John Shirreff was requested to draw up an account of the advantages of this implement,—which was immediately published by the Society; and premiums were at the same time offered to encourage its more general use in Scotland.—E.

ACCOUNT
OF
THE GRUBBER:

**AN INSTRUMENT RECENTLY INTRODUCED INTO EAST LO-
THIAN, FOR PULVERIZING THE GROUND, AND DIMINISH-
ING THE EXPENSE OF CULTIVATION. WITH AN EN-
GRAVING, A DESCRIPTION OF THE IMPROVED CONSTRUC-
TION, AND AN EXPLANATION OF THE ADVANTAGES AT-
TENDING IT.**

*Drawn up at the desire of the Highland Society of Scotland,
By Mr JOHN SHIRKES.*

THE means of simplifying and facilitating labour, have formed an object of solicitous attention, and engaged the minds of men of the greatest ingenuity in all ages, and in every civilized country. The invention of, and improvement in machinery, employed in the various arts practised, and manufactures fabricated in our own country alone, have been, in the memory of thousands now living, both numerous and important; and it may safely be asserted, that, by these disco-

veries and improvements, Great Britain has, in a great measure, been enabled to lead, and surpass the whole world, in the arts which constitute the basis of wealth, and create the resources of nations.

Only forty years ago our implements of agriculture were few, awkward, and clumsy ; of course their operations were, comparatively, slowly and imperfectly executed. From the improved construction of the plough, one man, and a pair of horses, or oxen, now do as much, or more work, than two men and four horses, or sometimes a dozen of oxen did, only thirty years ago, and to much better purpose. Even a single horse or ox draws a plough with ease, in performing several important operations in modern farming ; particularly in carting, and in the drill husbandry, as in depositing seeds, cleaning the intervals of rows, &c. ; and these practices have given increased satisfaction, and been almost universally adopted. A thrashing machine, attended by a man and three or four women, will do the work of from ten to twenty stout men, or more, using the flail, according to the size and strength of the machinery, and power employed to drive it; while it will execute the work much more completely, separating the grain from the straw, and the chaff and small seeds from the grain, all at the same time. It also delivers the grain for the market in a far drier, and sweeter state, than when the flail is used.

Various implements of different denominations, though generally of somewhat similar construction, have been introduced into modern practice, for working land, under certain circumstances, instead of the plough; and experience has proved, that they have effected that object at less expense, and in a shorter time, than can be accomplished by both the plough and the harrow combined. Under this impression, they have met with the approbation of, and been employed accordingly by, the best farmers in extensive districts of the island, particularly in England, under the appellation of scarifiers, extirpators, cultivators, &c.

The idea of the machine, an account of which forms the subject of this paper, was taken originally from one purchased a few years ago at Dunbar, at a sale of some articles belonging to the Earl of Lauderdale, by Mr John Dudgeon, tenant in Easter-Broomhouse. By Mr Dudgeon's directions it was simplified and improved, and brought to that state in which it is now used, as a most effective implement, by several of the best farmers in East Lothian.

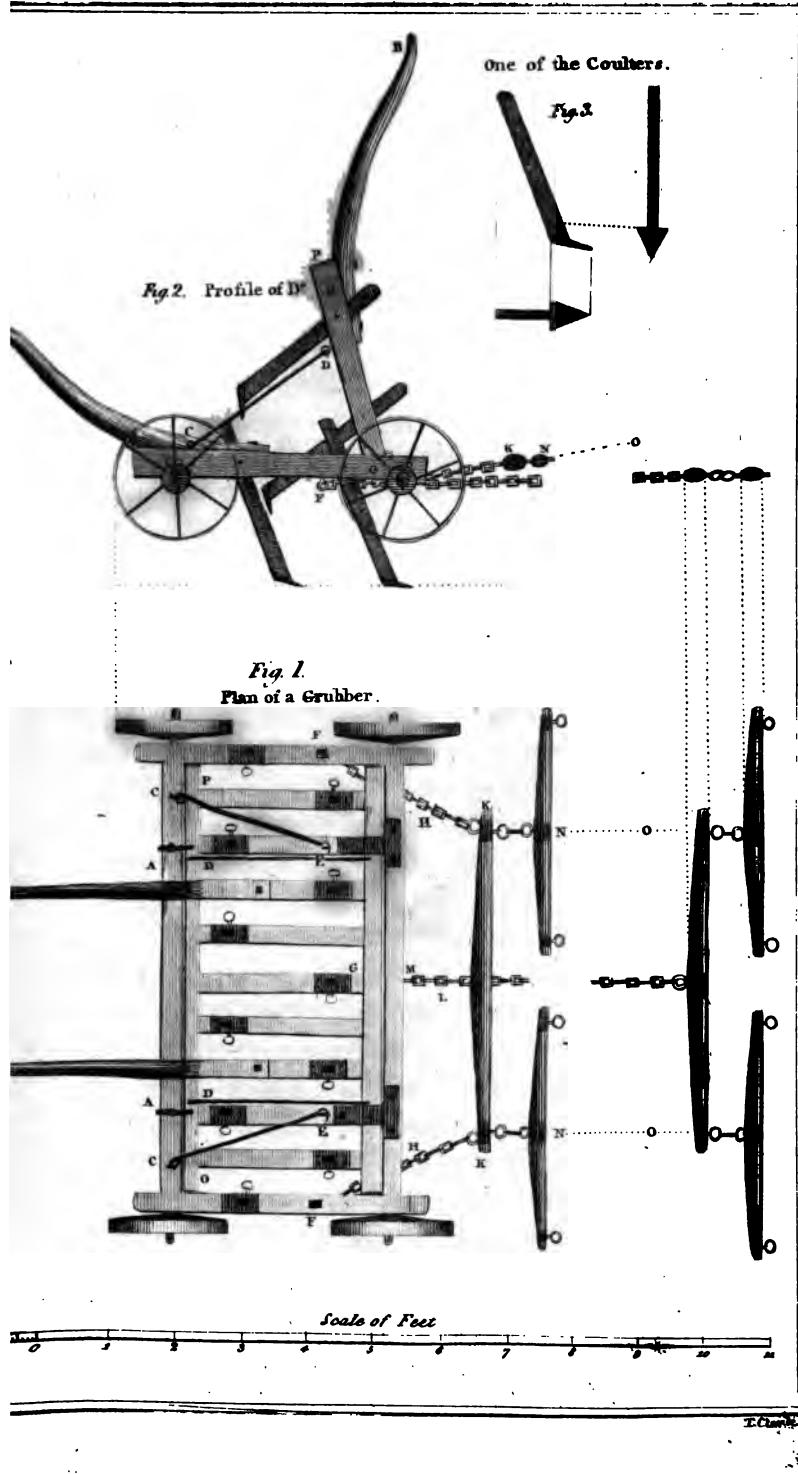
Form and Construction.

This implement, now called the Grubber, consists of two strong rectangular frames, the one including the other, and nine bars mortised into

the inner one, with eleven coulters or tines, with triangular, sharp-edged dipping feet, four cast-iron wheels, two handles, &c. (*vide* the plate.) Elm is considered the best wood for the frames and bars. The machine is made of various sizes. The following are the dimensions of a stout one, the property of Mr Charles Dudgeon, in Prora.

	Feet.	Inches.
Length of the outside frame over all	6	9
Breadth of this frame	3	6
Horizontal breadth of the wood of the frames and bars	0	3
Vertical do. or depth of do. of do. do.	0	3
Long hind swing tree, KK	5	10
Short hind do. each, NN	3	6
Soam, L, about	11	from G
Coulters, length	2	2
Breadth	0	1 $\frac{1}{2}$
Thickness	0	0 $\frac{1}{2}$

Within the outer frame the smaller, or inner, is placed, which is moveable on hinges fixed on the front beam of the outer one. The inner frame has two sides, or beams, into which are mortised nine cross bars, about eight inches distant from centre to centre. Into these bars the coulters are fixed, except two, which are placed in the side beams of the outer frame. The openings for the coulter have plates of iron above and below, for strengthening the wood, with top and



wards with screwed points, and fastened with corresponding screws. The lower ends of these bolts have eyes, or round holes, for fastening the extremities of chains HH, which are attached to the large swing trees KK by the other ends. The soam L is fixed below the inner frame at G, passing through a strong staple under the outer frame at M. A stout chain answers best for a soam ; though a good three-inch hempen rope twice laid (right hand laid) may do, and will cost about 4s. NN are the small swing trees, to which the two hindmost horses are yoked. The soam plays quite free under the large swing tree. The coulters stand reclined, and have steeled triangular feet, dipping a little as in the figures, about three to four inches broad at the base, and from five to six inches long from the base to the point of the triangle, which the scale determines. The beam PO of the inner frame, to allow it to rise by the handles, must have the under edge rounded off.

Application and Use.

One important purpose to which this implement may be applied, is to work, and thoroughly stir with it, summer fallows,—land on which potatoe or turnip has grown,—or any land that has been ploughed in autumn, or during winter, and is to be sown with a grain or pulse crop in spring, clover and other leys excepted. The great ob-

jection to sowing on the winter furrow has been, that the effects of a spring ploughing, to operate complete cleanliness, is lost. To this it may be answered, that it is a bad account of the state and previous management of either summer, turnip, or potatoe fallow, that it wants spring cleaning of root weeds, and that no good farmer ever relies on a spring ploughing to obtain that purpose, far less to destroy annual weeds, which a spring ploughing is sure to promote the growth of in a tenfold degree. But to all those farmers who require a spring ploughing to effect a radical cleanliness in their fallows, the Grubber is a *sine qua non*; for, by using this implement, these lands can be effectually stirred as deep as the plough goes, and all root weeds which their imperfect operations have allowed to lurk in the soil, will, at the same time, be cut up, and drawn to the surface by the reclined position of the coulters, and the sharp edges of their steeled, dipping, triangular feet, instead of being partially buried by the operation of ploughing, which, every body acquainted with the subject will admit, must happen. The grubber acting as a powerful harrow, with the additional execution of its sharp-edged triangular feet, does not materially alter the relative position of the component particles of the soil; thus affording a decided advantage in using this implement instead of the plough to work winter ploughed lands with in spring, particularly those of a strong nature;

preserving the fine, impalpable, mellow mould on the surface of the land, which maintains the internal body of the soil dry, by turning off the wet; preventing plastering, and subsequent hardening of course ; while, at the same time, the most genial bed is afforded for every description of grain, pulse, and grass seeds. Time is also saved, consequently expense. Early sowing, which despatch always ensures, is likewise obtained ; followed of course by a comparatively early harvest. In addition to all this, no fresh seeds of annual weeds are brought near the surface to vegetate, either to choke the grain crop they spring amongst, or to lay a foundation for doing so to future ones, which happens in all spring ploughed lands impregnated with them, unless they be destroyed by the hoe in row-culture, or picked out at an enormous expense in the broad-cast husbandry, by hand, *where hands can be obtained to do so*. A drilling apparatus could evidently be applied to the grubber, to deposit pulse, grain, or seeds of any kind, which would be a saving of time and labour. The seeds might be deposited by the drill when the grubber is working the land for the last time.

Advantages.

The advantages which have been derived from the use of the grubber, and similar implements,

to stir and render open winter ploughed lands in spring, and prepare them to be sown on the winter furrow, *can be instructed by the evidence of whole districts.* Those farmers, therefore, who exclaim against sowing spring crops on the winter furrow, must attribute the alleged failure of the succeeding crops of their rotation, to the defect of the salutary employment of an implement of this description, to give the soil friability and radical cleanliness, where such are wanted; and these gentlemen are desired to recollect, that it is essential to the establishment of husbandry, or any other art, on sound scientific principles, nay, for the dominion of truth itself, that negative experiment must go for nothing, where affirmative, in similar cases, has been successful. Were the negative admitted to supersede and nullify the positive, there would soon be an end to all improvement. The code of science would thenceforth continue a *carte blanche*, and mankind retrograde to their woods and wilds again.

Where lands have been laid down with cultivated herbage seeds, as red clover, &c. in a fair and clean state, and have been broken up, and cropped with oats, which are to be succeeded by beans; if the oat-stubble has been ploughed down in due time to allow the soil to be mellowed by frost, the land may be afterwards advantageously wrought several times by the grubber in spring, instead of the plough, and the beans put in by a separate drilling apparatus, or one attach-

ed to the grubber itself. Were a skim-coulter used to bury the oat stubble under a strong, deep furrow, the grubber would afterwards make a very neat operation. From an extract of a letter, written by Mr Charles Dudgeon of Prora, dated 12th April, 1814, (see the Appendix), it appears, that he has put in beans, peas, and tares, on the winter furrow, with the grubber this season. By an extract of another letter from the same gentleman, dated 19th of the same month, it appears, that both Mr Hay of Spott, and his (Mr Dudgeon's) brother in Broom-house, have sown beans, and afterwards wrought and cleaned the land with the grubber in an effectual manner. The crops of these gentlemen were drilled, and the grubber was set so that the feet did not reach the seed. But the employment of this implement will do no injury to broad-cast or shallow-sown beans, or any other pulse or grain crop, whether drilled or broad-cast, unless the operations be delayed till the roots have taken such a firm hold of the soil that they will not suffer to be moved by the machine. It was a common practice about forty years ago, in a township in East Lothian, to plough down barley with a shallow furrow, to destroy the annual weeds that had sprung amongst it, after the sprit of the barley was all fairly green and above ground. However singular this practice may appear to modern farmers, the fact can be ascertained by many still alive. The operation was attended with the best consequen-

ces, destroying an immense flush of annual weeds, and saving the crop of barley.

The grubber is likewise most effectually employed to forward operations in the preparation of land for potatoes or turnips, and that under summer fallow. The land having been previously ploughed in winter, or early in spring; to be mellowed by frost; if of a friable nature, may be attacked, as soon as the dry weather sets in, by the grubber, which will clean and pulverize the soil at the same time. If the land be very foul, the instrument may be set to work only a few inches deep, in going over the field the first time; setting the coulters deeper and deeper as it is found they can be effectually applied. After two operations of the grubber in very foul land, it will generally be found necessary to use the plough, to be followed by the grubber, as before, till the land is rendered as clean as circumstances will admit. If the soil be very strong, it will generally be found necessary to plough a second time, and roll the land, before the grubber can act with effect as to cleaning the soil. When strong land has been twice ploughed and rolled, the root weeds will then, in every case, part with the soil, and be brought to the surface by the grubber. Where there is much couch in the soil of a field, it may be divided into several compartments by plough furrows; in crossing these, the inner frame of the implement can be

raised up, and the couch and other root weeds collected by the coulters disengaged from them. The rubbish thus deposited in straight parallel rows, can be speedily collected either by a couch rake, or by hand with pitch or dung forks, to be scorched, or carted off the field, as may be most convenient and adviseable.

Another purpose to which implements of this description can be applied, is to work across, and level down the ridgelets formed in horse-hoed drilled beans, which can be done after the crop is removed from the field, previous to ploughing down the bean stubbles. If any couch, or other root weeds, be left in a well-dressed bean fallow, those will almost invariably be found on the tops of the ridgelets, among the stems of the beans, where they had lurked unseen, and undisturbed of course. These lurchers the grubber will most effectually exterminate; and the levelling of the ridgelets will admit of the land being ploughed with more ease, correctness, and expedition. Mr Greg of Hertfordshire, in his account of the use of an implement similar to the grubber, says, "In heavy lands it is very difficult to prepare the bean and pea stubbles for wheat, at so early a period as I could wish to sow them; particularly so last Autumn," (1808.) "The labour they required was so great, from the plough, roll, and harrow, as to induce me to try if the scarifier would raise a depth of mould sufficient to cover the seeds. *It performed the operation well;* and

should the part so managed look as well at harvest as at present, (20th May 1809), I shall continue to use the scarifier instead of the plough; by which means, I can sow in the season forty acres of wheat in a very few days, regardless of weather, and at a sixth part of the expense."

Mr Greg drills his wheat. In confirmation of Mr Greg's practice being a good one, as to scarifying, Messrs Higgins, Wilson, and Foster, in their report on the state of Mr Greg's farm at Coles, in June 1810, say, "The wheat sown after the scarifier, was very superior to that after clover and other green crops, notwithstanding the latter having been partially fed with sheep. We were gratified to find Mr Greg had made this experiment, as the superiority of the crop, and cleanliness of the land after the scarifier, and the regular rotation of his cropping, was strikingly evident."

If seed can be put in, in an uncommon dry autumn, on strong land, with the scarifier, to advantage, instead of the plough, there can be no doubt that it can be much more easily done on moderately loamy soils by the grubber; and on all soils of a softer texture, early in spring, after being mellowed by frost, and before the lands harden by the drought at all. If fewer coulters were used, that is, if the implement had only five or six coulters instead of eleven, and were only half the breadth of land occupied by it, and the

same power applied, it would probably prepare land after turnip, for the reception of barley and grass seeds, better than the plough, by stirring the soil effectually, while it did not bring up the seeds of any annual weeds to vegetate, shed their produce, and choke the cultivated crops of that and future seasons. Were the grubber reduced in breadth, and the same power applied to effect extraordinary purposes, it would require to be constructed stronger of course.

Implements of this description, on a reduced scale as to the number of tines or coulters, would be particularly useful on small farms, where a pair of horses or oxen only are employed. On these small farms, there is little opportunity of simplifying labour by dividing it; or employing hands for particular purposes. These cannot be had frequently for field labour, as gathering couch, &c.; and if they could be had, could not be attended to, because so few are required that they would not pay for a fit person to attend them. This operation the grubber performs, in a great measure, in the act of pulverizing the soil.

It is evident, the implement, applied to equal purposes, can be worked by a power in the ratio of the number of its tines or coulters; and, therefore, that grubbers can be used of different sizes to suit farms of forty acres, and upwards.

The imperfections which may seem to be attached to the grubber, in its present state, are, probably, 1. That the feet of the tines or coulters

are not wide enough to cover the whole space the implement travels over, leaving from two to three inches of soil unmoved between every two of the dipping feet. 2. From the very considerable dipping of the feet, the implement has a strong tendency to go down in the soil, which occasions a continual proportional pressure on the wheels to keep the tines from sinking deeper, consequently an increased labour to the horses that draw the implement. 3. Loss of time in slackening and shifting the wedges, when the depth the coulters are, or have been going at, is intended to be altered, which might perhaps be more readily done, by having the coulters fixed, and the wheels inmoveable.

The first mentioned seeming defect might be corrected by making the dipping feet about one and a half inches wider each.

The second defect has perhaps an equivalent, or even preponderating advantage, by keeping the implement steady to any depth the tines are set at, allowing them to penetrate and work, by their strong disposition to dip, more obdurate soil, than if the feet floated horizontally.

The third apparent inconvenience may be counterbalanced by the opportunity afforded of so readily taking out the coulters, to have the edges and points of them steeled and sharpened, which they must, in many soils, so frequently require.

566 **ACCOUNT OF THE GRUBBER,**

I have thus endeavoured to fulfil the commands of the Society, by describing the Grubber, and stating whatever appeared to me most deserving of notice regarding it; and I hope the attention that has been paid to this subject, will be the means of extending the employment of this useful implement in the arable districts of Scotland.

JOHN SHIRREFF.

No. 7, Piershill,
27th April, 1814.}

APPENDIX
TO THE
ACCOUNT OF THE GRUBBER.

I.

*Extract of a Letter from Mr CHARLES DUDGEON,
dated Prora, 12th April 1814.*

“As to my experiment on unploughed land, I have realized my intentions, and actually sown, on the winter furrow, peas, beans, and tares, all of which have got a good mould. The soil is of the nature of carse clay: it was ploughed-in in winter; and from being long exposed to the influence of the stormy weather, the shoulders of the furrow slices were much beat down, and the surface levelled. On some parts of the field I ordered the soil to be wrought well with the grubber, immediately after sowing the seed. On other parts I wrought the land with the grubber, in the first instance, and sowed the seeds afterwards; harrowing the lands with the common harrow. Some ridges I wrought with the grub-

ber ; and after a day's drying in the late drought, I sowed and wrought the seed in with the grubber, finishing the whole with a cross double harrowing with common harrows. Finally, I *ploughed* two separate lots or portions of the field, of two ridges each, and, when ready for harrowing, sowed and finished them off with the common harrow, along with the rest.

" The principle on which I was induced to try these experiments, is, that land, ploughed (a second time) in spring, is supposed to produce ~~much later crops~~ than when sown on the winter, or frosted furrow ; and as I had an opportunity of employing an implement, which effectually loosens winter-ploughed land, without turning up the raw unmettled particles of the soil to the surface, I determined to make the experiment ; varying it as much as was in my power ; and I firmly expect an earlier and better crop after the grubber than after the plough, with a considerable saving of expense between the operations of these two implements.

" In backward springs we can also derive advantage from the grubber in working fallows that had been prepared for wheat, but which an unfavourable preceding autumn had prevented from being sown then ; or such as had been prepared for oats or barley, in situations too high for wheat. Much time and expense can be saved, and the land rendered as friable and open as by a spring ploughing.

" I shall report the result of my experiments, as to the comparative time of maturing of the crops of peas, beans, and tares, sown after the plough and after the grubber. In the meantime, it must be noticed, that the grain sown by the grubber, is not, to appearance, some of it, sufficiently covered* by the mould."

II.

*Extract of a Letter from Mr. DUDGEON, dated
Prora, 19th April 1814.*

" In reply to your queries concerning the powers of the grubber, I must say, that I do not think the grubber is an implement fitted for breaking up unploughed land under any circumstances, unless a perfect sand. Even soft land, on which turnip had been eaten off with sheep, I should conceive much too firm for it. The case, how-

* This happens in consequence of sowing the different sorts of pulse broad-cast, on soil made very mellow by the frost. The particles of mould being more minute than the grains of pulse, these last are brought to the surface by the tines of the grubber, or harrow, as stones are. An implement such as Cook's, or Bayley's drill, would be very useful where the grubber is used, or seems rather indispensable. By these implements seed can be deposited at any depth or width between the rows. The common brush drill-barrow requires the plough.—J. S.

ever, which I stated in my last, must stand as an exception to my general observation.

" I stated, in that letter, that I had put in peas and beans on unploughed land, *i.e.* without again ploughing it in the spring. But it appears the circumstances were peculiar. The land was rendered as soft as sand by the severest frost, succeeded by the most gradual thaw we had ever seen. Being naturally wet at the bottom, or at the depth of a plough furrow, I determined to try the grubber, to prevent the crop from being too late. But this implement can only be considered in the light of an extremely powerful harrow.* Its principal use is certainly to accelerate

* Mr Dudgeon is now, however, convinced that he had underrated the powers of the grubber. He called on me on the evening of the 29th of April, and assured me, that Mr Andrew Howden, who is one of the most intelligent and active farmers in the county of East Lothian, had actually wrought land with the grubber this spring, that had carried a turnip crop, eaten on the land with sheep last winter, without using the plough at all.

Mr Dudgeon also added, that several other most respectable farmers had used the implement in putting in their spring crops this season, to a considerable extent, and much to their satisfaction. Among these, he mentioned Mr George Begbie of Queenston, near Dirleton, as having put in eighteen acres of barley with it in three days; and that Mr Stobbie of Kirklandhill, on the Earl of Haddington's estate, had put in all his broadcast peas and beans with the grubber.

So long ago as 1784, an implement of this sort was in use by some gentlemen near the town of North Berwick, particu-

our summer fallow process; for when summer fallow has been once or twice ploughed, harrowed, and gathered, the grubber is well adapted for bringing up again to the surface all couch and other root weeds which had been turned down to the inferior part of the soil, to undergo new and repeated harrowings and gatherings, till all be rendered clean, and prepared for the dung. It has this season been found of great use in cleaning land on which drilled beans had been sown, which the long continuance of backward weather prevented from being got completely cleaned before the beans were put in. By setting the feet to a certain depth, it may be freely used in working even *across* the drills. Mr Hay of Spott has done this most effectually, as has also my brother at Broomhouse, to much advantage. Mr Hunter of Tynefield does much work in preparing his fallows with it, and strongly recommends it for that purpose."

larly by the late Charles Dalrymple Esq. and by Mr Archibald Lauder, on the Abbey and Haugh farms. I had one myself for many years. It was not nearly so strong an implement, nor so effective, to appearance at least, as the grubber seems to be. It was called an Edget. I think Captain James Dalrymple will recollect it. Mr Lauder is still alive. It was on his farm I first saw the implement operate. The tines were fixed, standing perpendicular,—the feet not dipping, but forming a right angle with the tines. The wheels were only two. These stood in front of the machine; and, being moveable upwards and downwards, regulated the depth the tines were intended to work at.—J. S.

III.

*Extract of a Communication from Mr JOHN HOOD,
Tenant in Langyester.*

" I find the grubber answer remarkably well, after land intended for fallow has got a furrow or two. It seems most adapted for light sandy soils, where the harrows generally carry so much earth along with them, that they do not bring up the quickens that are deep in the soil ; and if another furrow be given, it generally puts much of them too deep again for the harrow. The grubber brings all root weeds to the surface, to be shaken free of earth by the harrows, and removed from the field. The tines of the grubber require to be set wider in the working of foul, light soils, than strong or clay soils. The implement requires four horses to work it ; but it can go over a great breadth of land in a day. I generally work the same land twice with it, then give a furrow with the plough, which prepares it for being wrought again to more advantage with the grubber.

(Signed) JOHN HOOD."

Langyester, }
11th March, 1814. }

IV.

*Proceedings of the DALKEITH FARMING CLUB, held
on 26th December 1811, regarding a Scarifier,
presented for the consideration of the Society on
that Day.*

SIR JOHN SINCLAIR, upon his health being given from the Chair, addressed the meeting in a speech to the following effect.

" He observed, that it afforded him much satisfaction, that, at last, he had had an opportunity of attending so respectable an institution as the Dalkeith Farming Club, of which he had the honour of being elected a member some time ago. It was an additional pleasure to him to attend on this occasion, since he had it in his power to present to the consideration of the Society an implement, known in England by the name of Scarifier, &c. which is hitherto but little known in this part of the kingdom. He was confident, however, that it would prove an important acquisition to the agriculture of Scotland; and he hoped soon to see it introduced into general practice. In order that the members of this Society might be induced to give this implement their sanction, he would shortly state a few of the advantages that were likely to result from its use.

" He was fully of opinion, (and that opinion

was strengthened by the concurrence of several intelligent practical farmers with whom he had conversed on the subject), that this implement would save one ploughing after a crop of turnips, when fed off with sheep ; for the land, after being properly stirred up by the scarifier, would be sufficiently prepared for being sown with wheat, barley, or oats, without any additional ploughing. This implement might likewise be successfully employed, in the spring months, on land which had been ploughed in autumn, or early in winter, preparatory to its being sown with oats or barley. It was a common practice, on clay soils, to plough a second time previous to sowing these kinds of grain ; but it is well known to every experienced farmer, that the second ploughing has a tendency to turn up a sour and unfertile soil, and to bury that part of the earth, which, having been exposed to the influence of the frost in the course of the winter, had been materially improved. Here, by using the scarifier, the improved soil would still remain on the surface ; and any weeds infesting the land, would be as effectually destroyed by that implement, as by a second ploughing. Thus, a double advantage would be obtained, namely, a more suitable bed for the seed ; and a ploughing, which would take up much longer time than is necessary for going over the land with the scarifier, would be saved. In preparing land for barley on light soils, the saving would be very great ; and in fallowing land sub-

ject to be overrun with annual or root weeds, the scarifier might likewise be used with much advantage, after the land is reduced to a proper degree of fineness, by ploughing, rolling, &c.

" He regretted much that, owing to the state of the weather at the time (an intense frost), it was impossible to try the scarifier, as he had hoped might have been the case ; but as he intended to leave with the Society one of these implements, calculated for strong, and another for light land, he requested that a committee might be appointed to have them tried so soon as the weather would permit."

Agreeably to SIR JOHN SINCLAIR's desire, a Committee was named to attend to the trial of the scarifiers, who reported thereon in the following terms :

" We, three of the Committee appointed by the Dalkeith Farming Club to judge of the merits of the scarifier, tried on Chesterhall farm on the 25th April 1812, are of opinion that it is a very useful implement of husbandry, *even in its present state*; and are also of opinion, that considerable improvements may be made on the said machine. It covers as much land as four ploughs, and completely answers the purpose of a ploughing after the lands are in a loose state, from the operations in the first stage of a summer fallow.

ing; and we hereby recommend it, in strong terms, to the attention of the Club.

(Signed) JOHN BRODIE.

JAMES REID.

ARCH^a. AINSLIE. "

V.

Extract of a Letter from ROBERT HAY Esq., dated Spott House, 30th March 1814, to Mr DUDGEON, Prora.

" With respect to the implement of husbandry called the grubber, it appears to me a very useful machine; and I certainly consider that your brother, Mr Dudgeon of Easter Broomhouse, deserves great credit, he being the first person who brought the machine into real use in this part of the country. I made some little alteration in my own; but I could not call it an improvement. I should be happy if you could come and see it yourself; you could then be able to judge whether it be so or not. *

" I think your brother is justly entitled to receive a premium for the great service he has done to the country, by directing our attention to this implement." †

* Mr Hay had applied a wheel in front, to facilitate the turning of the implement; but he has since considered it of little utility.

† The price of the Grubber is necessarily according to its size and strength—the strongest from 11*l.* to 11 guineas, to be worked with four horses. E.

ESSAY

ON THE

BEST METHOD OF PRESERVING POTATOES FROM THE EFFECTS OF FROST DURING THE WINTER SEASON;

OR

For rendering those which have been penetrated by Frost fit for Food; converting them into Starch, Fermented Liquor, Ardent Spirits, and other useful purposes: With the depth and extent of the Pits in the Earth deemed most eligible for preserving them; also the depth of Earth or other Substances which it is proper to use as a Covering over the Pits, when the Potatoes are lodged.

By THOMAS DAILLAS, Merchant in Edinburgh.
Written in 1815.

THE productions of the earth are various, and their utility, by the ingenuity and art of man, is equally various. The potatoe is a vegetable which affords wholesome food for man and beast;

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and therefore ought to be cultivated with the greatest diligence, and preserved with the utmost care. They are, more than any other vegetable or root, liable to be affected by frost, so as to render them fit only for the dunghill.

The weather which soonest injures and destroys potatoes, is when the atmosphere is depressed with cold to such a degree, that it congeals water ; then potatoes, unless covered, will be frosted ; and the cover proper to preserve them ought to be proportioned to the intenseness of the weather.

Potatoes, when slightly frosted, so as to have acquired a slight sweet taste only, often like an animal body suddenly infected by some disorder, which it throws off by perspiration, are found quite wet, throwing out the frost by a kind of perspiration. When they are in this state, in order to recover them and bring them to a proper taste, the whole quantity infected should be turned over, and a quantity of mill-seeds thrown among them, as they are turned over : this both extracts and absorbs the injured moisture from the body of the potatoes infected. But there is still a more powerful remedy than simply mixing them with mill-seeds ; and that is, a small quantity of slaked lime, perfectly dry, mixed among the seeds to be used ; which has a very wonderful effect in recovering potatoes that have been considerably injured by frost.

When frosted potatoes are to be used, either

at the table, or given to horses, black cattle, or swine, plunging them about half a day in cold water before using them, is of great advantage; and if put into running water, so much the better, as it has been proved to be more powerful in extracting the frost, on account of its alterative quality and superior purity.

Another way of removing frost from potatoes, when they are to be prepared for the table, is to strip them of their skins, and if large, to cut them into two or more pieces; then to plunge them in cold water for a considerable time, with a handful of salt in the water; and, when put on to be boiled, put as much salt into the water as possible, not to make them too salt when boiled. This is a powerful way of making the potatoe throw off the bad taste and spoiled quality lodged in its substance.

When prepared for horses, black cattle, or swine, salt or saltpetre put among the potatoes, and boiled together, will destroy any injurious quality which frost has lodged or brought on. Chaff or oats, bruised in the mill, boiled together with the frosted potatoes, when designed for horses or cattle, greatly destroy the bad effects of the frost.

When potatoes have acquired a disagreeable taste by means of frost, they will make good and wholesome bread, by boiling them, as has been mentioned, with salt; mashing or bruising them

small, then kneading them together with oatmeal. Not less than two-thirds should consist of meal, which will destroy the sweet taste; and the dry and generous quality of the meal will effectually correct and destroy any thing noxious in the injured root.

Horses, swine, dogs, &c. may all be fed with potatoes, though frosted, by boiling them, and mixing them with oats coarsely ground, or with oatmeal; always adding a good quantity of salt or saltpetre in the mixture. Poultry also may be fed with potatoes very much frosted, if mixed with oatmeal in about equal proportions, without salt, as this species of animal cannot admit of it.

Starch.—Potatoes much frosted will make very good starch; though it is a shade darker in the colour. All coarse cloths requiring to be stiffened, where whiteness is no object, may be done with starch made from potatoes greatly penetrated with frost. The best method of making potatoes into starch, is to grate them down among water, then to take out all the refuse with the hand, and next to strain the whole of the water in which the potatoes have been grated, through a thin cloth rather coarse, or fine sieve, and afterwards frequently putting on and pouring off water, until it comes clear from the starch, which is always allowed to settle or fall to the bottom of the vessel in which the operation is performed.

An experiment was tried with a few potatoes that weighed 16 ounces, with an equal weight of potatoes that were put out to frost. They were grated down, and made into starch powder: The produce of the fresh potatoe weighed 876 grains, while that of the frosted was only 412, being less than half the quantity.—The samples, as produced, are sent herewith; the fresh potatoe producing 1-8th, and the frosted 1-17th, 440 grains being an ounce.

The refuse of the potatoe, when taken from the sieve, possesses the property of cleansing woollen cloths, without hurting their colour; and the water decanted from the starch powder is excellent for cleansing silks, without the smallest injury to the colour. In making hair powder, it has long been used, and is therefore well known.

Fermented Liquor.—Wine of considerable quality may be made from frosted potatoes, if not so much frosted as to have become soft and waterish. The potatoes must be crushed or bruised; a wooden mallet answers the purpose. If a plank of wood is made hollow, in the manner of a shallow bowl, they may be bruised with a mallet, or put into a cyder press. A Winchester bushel must have ten gallons of water, prepared by boiling it, mixed with half a pound of hops, and half a pound of common white ginger. This water, after having boiled for about half an hour, must be poured upon the bruised potatoes, into a tub

or vessel suited to the quantity to be made. After standing in this mixed state for three days, yeast must be added, to ferment the liquor. When the fermentation has subsided, the liquor must be drawn off, as pure as possible, into a cask ; adding half a pound of raw sugar for every gallon. After it has remained in the cask for three months, it will be ready for use.

FURTHER USES TO WHICH POTATOES FROSTED MAY BE BENEFICIALLY APPLIED.

Potatoes frosted, when three times distilled, produce a spirit from hydrometer proof to 10 *per cent.* over proof; therefore a principal purpose and use to which they may be turned, is the making of alcohol ; more particularly as that article is useful for many purposes where strength is its principal recommendation. The ordinary strength that spirits are run, preparatory to converting them into alcohol, is from 40 to 50 *per cent.* over proof by Dicas ; which, redistilled from calcined carbonate of potash, will produce alcohol at 825,—water being 1000.

When potatoes are frosted to such a degree as to be useless for food from their sweet taste, they are very useful to weavers in dressing their yarn, particularly cotton. They are prepared for this purpose by boiling them well ; then mash or beat them small ; then put them into a vessel, adding a little barm, drippings of

ale or porter barrels ; allowing them to stand two or three months to ferment.

Shoemakers may use it also ; only, as their paste requires more solidity and greater strength, flour is generally mixed along with the fermented potatoe, in about equal proportions.

Bookbinders also may use this paste ; alum being mixed to assist the strength of the composition. And it may be beneficially used by paper-stainers and upholsterers, when made up of a mixture of flour and alum.

When potatoes are so penetrated with frost that they have become quite soft, they are useless for man or beast ; but make excellent manure for light sharp soils ; and for this purpose are worth about one-fifth, or sixth, of their original value. In Berwickshire, and other places, where it is a great object to get their straw turned into dung, the value of the frosted potatoe is still greater, as it assists the farmer in that operation.

Preserving Potatoes from Frost.—This is best done, by filling completely the place where they are deposited, whether it be a house or a pit, and allowing the place to remain shut during the winter. But this cannot be done easily with a potatoe-house, as it cannot be completely packed or filled like a pit. Besides, some potatoes are generally wanted daily ; and thus air is admitted, and a greater vacuity constantly making ; both which are very likely to be the

means of proving injurious or destructive to what potatoes may be in the house, when a severe frost sets in. There is no such thing in nature as a vacuum ; therefore, if a place is not filled with some substance or other, it will be filled with air. For this reason, pits are better for preserving potatoes from frost than a house, because a pit can be more effectually filled ; and, by opening a pit when potatoes are wanted, and removing the whole into some part of a house, and still keeping over them a covering of straw, turf, or divot, the potatoes are kept close. A potatoe-house, however, is very useful, and what every farmer ought to have, as in this house he may still keep a small quantity of his crop for daily use, by emptying a pit occasionally, and keeping them always well covered with straw, as has been already mentioned. The potatoe-house ought to be well plastered with clay, and perfectly dry before using it.

Pits, for the reasons stated, are deemed the safest and best of all for preserving potatoes from frost, and the smaller the better for that purpose. The smaller the bulk, penetrating frost air has the less effect upon it, and the safer it is sheltered. Who has not observed potatoes here and there in fields ploughed in the spring, which had remained all the winter under a very slender covering, and this entirely owing to the bulk not making any exposure ? But it may be inconvenient to have perhaps less than three or four

carts for the purpose of removing them into the potatoe-house ; and therefore pits of this size will be necessary.

The depth and extent of these pits must, in a great measure, be regulated by the extent of the crop, or the quantity necessary to be deposited. But they must never be made so deep as to reach clay or till ; for either of these draw water, and, besides, never fail to give the potatoe a bad or an earthy taste.

Potatoe pits should be made upon ground that has a southern exposure, a deep soil, and declining to a considerable distance from the pit. The air is never so severe where the exposure is a southern one, as it is in others. In a deep soil, the pits can be made sufficiently deep before reaching any cold bottom ; and the declivity carries away water. When the pits have been fully finished, and covered, a sod should be cut out all the way round the potatoes, and the cut continued a little way as the descent points out. A pit of about two feet deep, six wide, and ten long, will hold four to six cart-loads of potatoes. The covering should consist of straw, fern, rushes, &c. next the potatoe ; then the whole of the earth dug out should be thrown upon the heap ; and, last of all, a covering of turf or divot, if done in the best way. This covering will be about two feet thick.

Some, however, place the potatoes in heaps of a long form, of about three carts together ;

means of proving injurious or destructive. Potatoes may be in the house. A quantity of air sets in. There is no such vacuum; therefore, if a some substance or other air. For this reason, ing potatoes from fr pit can be more effe ing a pit when r ing the whole; keeping over

ound the thick, not winter, the should be in a spade until g would be greatly covered with turf all , or any thing to give the om the top.

and easiest way of preserving potatoes, he or the farmer to drive all his potatoes farmer and to lay them upon dry ground, without still ,ing the surface, and as near the stables as use able; putting them in heaps of about three th four carts, then covering them with straw, and, above that, with turf where it can be com banded, or with a neat thatching of straw: Then let a quantity of stable dung, of the roughest kind, and the newest, be laid upon each heap, to remain during the winter, but which must be removed in the spring. As the weather appears severe, the quantity of dung may be increased at pleasure. If this practice were adopted, few or no potatoes would be penetrated by frost, as none would be in hazard except one pit, or part of it, when it was removing, or placed in the potatoe-house, during the winter season.

Ardent Spirit.—Potatoes that have been injured by the frost, produce a much greater quantity

ty of spirit, and of a much finer quality, than those that are fresh ; they require a proportion of malt wash to promote the fermentation. About one-fourth part of malt-worts, or wash, ought to be fermented at least six hours before the potatoe wash is joined to it ; otherwise the potatoe-wash, having an aptitude to ferment, will be ripe for the still before the malt-wash is ready : hence, the effect will be, to generate an acid which renders the spirit coarse, and, when diluted with water, of a milky or bluish colour. When the spirit is strong, the acid is held in solution ; but appears as above, when diluted with water.

Malt spirit is commonly run twice through the still, but potatoe spirit should be run thrice.

The quantity of spirit which the potatoe in a sound state will yield, depends much on the relative quality of the root : so will the quantity be more or less.

The writer of this essay, to ascertain accurately what difference there was in the quantity and quality of the spirit which potatoes will produce, when in a sound and in a frosted state, made the following experiments.

Four pecks, or one-fourth part of a boll of fresh potatoes, of the red or mealy kind, raised in September, were washed and cleared of earth and sand, and weighed 112 lib. ; they were well mashed and broken with a mallet, and put into a vessel, to which was added 12 gallons of water, heated to 180°, and covered up : In two hours this was drawn off, and 16 gallons boiling water

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added, and allowed to remain 12 hours. The remainder of the mash was put into a hempen bag, and squeezed out in a press, which produced 2 gallons more of extract. By Dicas's saccharometer, 59 h. 49 w. equal to 16 lib. of saccharine matter to the barrel: to this quantity of 30 gallons were added, 4 gallons of fresh worts, at 80 lib. to the barrel, in a full state of fermentation. It had attenuated to a degree heavier than water, but would come no lighter, *the fermentation being over.* In eight days it was distilled, and produced $\frac{2}{3}$ of pure spirit, 6 over proof, as per sample* No. 1.; and $\frac{1}{3}$ of spirit, 56 under proof, (having run the last to water, that the real quantity might accurately be obtained), as per sample No. 2.; which is sent merely to show, that the potatoe spirit, when weak or unrectified, is coarse, with a stronger potatoe flavour, having both the feints and the essential oils combined. The value of the spirits, in proportion to 10s. per gallon, 10 under proof, equal to 11s. 1d. hydrometer proof, is 5s. 7d.

Another trial was then made, which was better. An equal quantity of the same kind of potatoes was prepared as the last, and weighed 112 lib. They were *grated down*, and the whole put into a vessel, on which were thrown 20 gallons of water heated to 190° , which remained two hours, and was then drawn off, and 20 gallons more of boiling water put on, which remained 12 hours,

* See Specification annexed.

well covered up, and then drawn off. The refuse was put into a boiler, and boiled for two hours with ten gallons of water: When the whole had been drawn off, and cooled down to 58°, and put into a cask, 4 gallons of fresh worts, that had been fermenting six hours before with 1½ gallon of yeast, were added, and the whole was kept in a place where the heat was regulated from 60° to 63°; for, if too hot, the liquor is apt to go into acidity, and if too cold, it would retard the fermentation, and run the risk of going also into acidity and consequent putrefaction.

In eight days the fermentation was over, and the whole quantity of wash operated upon was 54 gallons. This, when distilled, produced 6½ gallons low wines, (88 under proof); and in doubling, 1½ gallons spirit, (57 under proof); and in tripling, ½ pure spirit, (11 over proof), as per sample No. 3.; and ½ spirit, 67 under proof, having also been *run to water*, for the reason before given. The value of which, at the proportion of 10s. per gallon, 10 under proof, or 11s. 1d. hydrometer proof, is 6s. 1½d.

Having, in this way, ascertained the quantity of spirit which potatoes, when fresh, produce, a third trial was made of the frosted potatoe.

112 lib. of the same kind of potatoes were washed, and cleared of earth and sand, and exposed for some days to the frost; then taken in and spread on a floor, where they soon became soft and waterish, appeared to be going fast to

decay, and were, as far as could be judged, more than half, or nearly two-thirds frosted. They were grated down, and the same quantity of water, at the same heat as in the last experiment, put upon them, mashed and fermented in every respect the same. The quantity of wash they produced was 56 gallons, which, when distilled, produced 10 gallons low wines, (90 under proof); and in doubling, $2.\frac{1}{2}$, (69 under proof); and in tripling, $\frac{4}{3}$ of pure spirit, 2 per cent. over proof, as per sample No. 4., and $\frac{5}{3}$ of spirit, also run to water, 65 under proof;—the value of which, in the proportion of 10s. per gallon, 10 under proof, or 11s. 1d. hydrometer proof, is 9s. 2½d.—showing a greater extract from the frosted, than the fresh potatoe, by more than 50 per cent. This experiment, which the ingenuity of the Highland Society first suggested, was perhaps never made before.

In mashing grain for distillation, water at 180° extracts its saccharine matter, which water boiling does not do. In the same way, the frost acting powerfully on the globular parts of the potatoe that contains its saccharine substance, completely dissolves and extracts it.

The comparative quantity of spirits which the potatoe in a sound or frosted state would yield, being the principal thing to be ascertained, the greatest care was taken during every stage of the operation, and every charge of the still run to bead 998, being as near water as it was possible to come.

Regarding the quality of the different samples, it will not be difficult to say, that No. 4, the frosted sample, is very superior, and nearly resembling Leeward Island rum; and is of a finer flavour and richer quality.

The experiments made, however accurate, being on a comparatively small scale, there can be no doubt but that, were frosted potatoes used in distillation in larger quantities, their produce would be proportionably more. This mode of using them might be beneficial to the farmer in severe seasons, when the potatoes could not be raised before being injured by the frost; it would occasion a saving of grain; and what has generally been considered of no use, might thus be brought into value.

The specification of quantity, strength, and value, is annexed.

Note. *The value of spirits under hydrometer proof, can be accurately ascertained by multiplying the quantity of strength short of 100, by the price of hydrometer proof spirit, and then dividing by 100.*

592 ON THE PRESERVATION OF POTATOES, &c.

SPECIFICATION.

Distillation of the Fresh and Frosted Potatoe, Gallons Wash.	LOW WINES.		SPIRITS. 2d Running.		SPIRITS. 3d Running.		Strength.	Gallons.	Gallons of Hydr. Proof Hyd. Proof Spirits from Spirits from the Root of Potatoes.
	Gallons.	Strength.	Gallons.	Strength.	Gallons.	Strength.			
1. Experiment from fresh potatoes...	36	5	70 un. P.	$\frac{14}{11}$	35 un. P.	$\frac{9}{7}$	6. 0. P.	$\frac{1}{2}$	56 un. P. $\frac{5}{10}$
2. Experiment from fresh potatoes...	54	$6\frac{1}{2}$	88 un. P.	$1\frac{8}{11}$	57 un. P.	$\frac{11}{9}$	11. 0. P.	$\frac{1}{2}$	67 un. P. $\frac{55}{100}$
3. Experiment from frosted potatoes...	56	10	90 un. P.	$2\frac{11}{11}$	69 un. P.	$\frac{16}{13}$	2. 0. P.	$\frac{1}{2}$	65 un. P. $\frac{84}{100}$
									3. $\frac{16}{100}$

VALUE of the different Experiments, as referred to in the Essay.

1. First of 3d Running * $\frac{12}{11}$ spirit 6.0 P. at 11s. 1d. Hydr. P. eq. to 11s. 9d. - - - L.0 3 4 }
 1. Second of do. * $\frac{12}{11}$ spirit 56 un. P. at do. - - - 0 2 3 } L.0 5 7
 2. First of 3d Running * $\frac{12}{11}$ spirit 11.0 P. at 11s. 1d. Hydr. P. eq. to 12s. 4d. - - - 0 4 9 }
 2. Second of do. $\frac{12}{11}$ spirit 67 un. P. at do. - - - 0 1 $4\frac{1}{2}$ \frac{1}{2}
 3. First of 3d Running * $\frac{12}{11}$ spirit 2.0 P. at 11s. 1d. Hydr. P. eq. to 11s. 3d. - - - 0 5 7 }
 3. Second of do. $\frac{12}{11}$ spirit 65 un. P. at do. - - - 0 3 7 } 0 9 2 $\frac{1}{2}$

* Samples produced.

R E P O R T

OF THE

**COMMITTEE APPOINTED BY THE HIGH-
LAND SOCIETY OF SCOTLAND,**

TO

**CONSIDER WHAT IS THE BEST MODE OF FORMING INSTI-
TUTIONS OF THE NATURE OF SAVINGS BANKS, FOR RE-
CEIVING THE DEPOSITS OF LABOURERS AND OTHERS.**

IT has always been remarked, that the labouring classes do not, in general, avail themselves of the time of health and plenty, to lay up a small provision against accidents and old age; but spend, at the moment, in vanity or dissipation, the whole of their surplus gains. The consequence of this propensity is, that upon a rise in the price of provisions, or want of work, or sickness, to however small an extent, individuals of those classes are first forced to the pawnbroker's (which takes place to an incredible extent daily); and when

their furniture and clothing are thus thrown away for a fourth of their value, they are frequently driven upon the parish. This unfortunate propensity is owing partly to improvidence; and partly to the difficulties and discouragements attending any attempt to accumulate their small savings. The former cause is gradually diminishing in proportion to the advance of cultivation. The latter is also diminishing, in consequence of the institution of different establishments intended to remove it; to which the notice of the Committee has been directed.

Friendly Societies.—During the last century, a number of *Friendly Societies* have been established by the Labourers in different parts of Great Britain, to enable them to make provision against want. The principle of these Societies usually is, that the members pay certain stated sums periodically, from which an allowance is made to them upon sickness or old age, and to their families upon their death. These Societies have done much good; but they are attended with some disadvantages. In particular, the frequent meetings of the members occasion the loss of much time, and frequently of a good deal of money spent in entertainments. The stated payments must be regularly made, otherwise, after a certain time, the member (necessarily from its being in fact an insurance) loses the benefit of all that he has formerly paid. Nothing more

than the stated payments can be made, however easily the member might be able at the moment to add a little to his store. Frequently the value of the chances on which the societies are formed is ill calculated ; in which case, either the contributors do not receive an equivalent for their payments, or too large an allowance is given at first, which brings on the bankruptcy of the institution. Frequently the sums are embezzled by artful men, who, by imposing on the inexperience of the members, get themselves elected into offices of trust. The benefit is distant and contingent ; each member not having benefit from his contributions in every case, but only in the case of his falling into the situations of distress provided for by the Society. And the whole concern is so complicated, that many have hesitation in embarking in it their hard-earned savings.

Menages.—The disadvantages of Friendly Societies have given rise, in many parts of the country, to institutions known by the name of *Menages*. The principle of these institutions usually is, that a certain number of persons agree to pay a certain sum each, periodically, for a certain period, (for the trouble of keeping which they pay a premium) ; and during that period, or at the end of it, each member receives the amount of his contributions ; by which means the members are enabled to accumulate a small sum to buy a piece of furniture,

to pay their rent, or to lay in a stock of meal or other provisions, which, from their improvidence, and from the impossibility of their keeping money by them unspent, they could not otherwise have accomplished. These institutions are usually established, for his own advantage, by some retailer of those articles which persons in the situation of labourers have occasion to purchase, very often by the keeper of a tippling house ; and the result is, that the members often spend four shillings when they deposit two ; they are usually induced to accept of goods, as the money is often spent by the collector ; and not unfrequently they get nothing at all.*

Savings Banks.—Such being the disadvantages of Friendly Societies and of Menages ; and it appearing, to many, that one great cause of labourers spending the whole of their earnings, viz. their having no easy, simple, and secure mode of depositing their savings to advantage, still subsisted in considerable force, *Parish Banks*, or *Savings Banks*, have been established in different parts of Great Britain, for receiving small deposits, and repaying them, when desired, with the highest interest which can be afforded. The very great success of these estab-

* The first application for a loan from the Edinburgh Loan Fund (to be mentioned presently), was rendered necessary by the failure of one of these Menages, in which the applicant had gradually deposited 4*l.* to pay a bill.

blishments in promoting economy, sobriety, industry and happiness, has induced the Highland Society to inquire into the best mode of framing them, in order to render it more easy in other parts of the country.

The Committee do not think it necessary to trouble the Society with the details of the information which they have collected with regard to each of a number of different establishments of this description, and for which they are much indebted to the ready communication of the framers and conductors of these establishments. It is sufficient to point out the general features of such establishments, and to give a short view of such a plan as seems sufficiently practicable in ordinary cases, but which must, of course, often be modified, to adapt it to local circumstances. *

The first question for consideration is, Whether it be better that the Bank be planned and conducted principally, or at all, by the persons who are to use it, or by persons in a higher situation in life? That the general frame must be formed principally by persons of education and

* ‘ It might be extremely useful to have Country Banks, where the smallest sums would be received, and a fair interest paid for them. At present, the few labourers who save a little money, are often greatly at a loss to know what to do with it; and, under such circumstances, we cannot be much surprized that it should sometimes be ill employed, and last but a short time.’ — *Malthus*, vol. II. p. 401.

knowledge of business, is quite apparent ; but, in some instances, the ordinary contributors hold regular meetings, monthly or quarterly, for examining the state of the establishment, forming rules, electing officers, and the like. The Committee, however, are rather inclined to think that this is, in general, an objectionable course, and is in fact one of the great disadvantages of the Friendly Societies, occasioning loss of time, dissipation, and expense ; and that, though it must be submitted to, where matters cannot be otherwise arranged, and may, sometimes, be advisable to a small extent, in order to produce confidence and popularity, it will generally be the most beneficial arrangement, that the concern be entirely planned and conducted by individuals of knowledge and experience, of a higher station ; so that those who use the Bank, may have nothing to do but to pay in or draw out their money as in an ordinary bank. This is the footing on which a very thriving bank for servants was established at Bath about seven years ago, on which the Edinburgh Bank has been established, which has been extremely successful, and on which a Bank has been established at Alloa, which drew 70*l.* during the first seven weeks. Perhaps there may be more difficulty in getting this arranged in the country than in towns ; but even there, probably, the minister, and a few of the respectable resident landholders and farmers of the parish might join in putting such an establishment in

motion, and in attending one hour a week, by turns, for receiving and paying money. The Committee observe, indeed, that the Parish Banks, both in Ruthwell and West Calder, are conducted by the subscribers as a society, holding regular periodical meetings of the members, for forming rules, electing officers, &c.; the latter consisting entirely (it appears) of persons contributing on their own account; the former comprising a certain number of honorary and extraordinary members, who are contributors to a surplus fund forming part of the establishment, (which is applied in giving compound interest at 5 per cent., on marriage, 56 years of age, or other occasions thought proper by the Directors, and in giving relief in sickness, &c.) But probably this was rendered advisable in these two parishes, chiefly because there were Friendly Societies already established in them, which might make it appear expedient to hold out, to the contributors to the Bank, the same powers of administration and legislation as those possessed by the members of these Societies.

Another question occurs, How far it is expedient to compel payment of certain small sums, at regular intervals, by imposing forfeitures of interest, &c. in order to keep the members in mind of the establishment; leaving them at liberty, of course, to contribute as much more as they may find convenient. This is done at West Calder, and is proposed to be introduced at Ruthwell,

and will no doubt have the effect intended. But it is not done at Bath, Edinburgh, or Alloa ; and the Committee doubt whether its good effect, in one way, may not be more than counterbalanced by its bad effect in another way, in deterring persons from entering into a scheme where there is any compulsion. Mr Bone, author of Tracts on Political Economy, who established an office in London to enable labourers to make provision for sickness and age, confirms the Committee in this opinion, in a communication with which he has favoured them, and in which he says—‘ No one should be made dependent upon any other contingency but his own convenience, for either the time or the amount of his payments : therefore, no attempt should be made to enforce regularity of payments by fines or forfeitures of any sort.’ And accordingly, the Committee understand, from some of its members who attend at the Edinburgh Bank, that one of its greatest recommendations, and which has induced many to become contributors, is, that those entering are not bound to go on, unless they incline ; and that, at the same time, very few of its numerous contributors have discontinued. It appears, at least, that it is safest to commence upon this footing, in order to hold out the greatest possible encouragement to the beginning of habits of economy. If any compulsion of regular payments to a certain amount be thought advisable in any place upon experience, the alteration can be made afterwards.

The Committee observe that, in some establishments, those who have been members for a certain time, have greater advantages than those who have recently entered. But this is not usual; and the Committee rather think that, as the commencement of saving habits is more difficult than the continuance of them, it is hardly advisable.

With regard to the interest to be allowed, this must be such as can be afforded by the most judicious management of the funds. The public banks are generally disposed to favour such establishments, by giving advantageous terms for their deposits. But, even where these are not allowed, *4 per cent.* may be procured, by paying in the sums on deposit receipts, and allowing them to lie for six months. If the interest be computed at the Savings Bank by months, and only upon sums of a certain amount, which is usual, there will, even upon the most unfavourable terms, be a sufficient profit upon the capital, after paying stationery, (which of course will be the only expense), to allow *4 per cent.* to the contributors. Where better terms are obtained from the public bank, better terms can of course be given to the contributors. Any surplus profits which may arise can be added periodically, as is done at West Calder, for instance yearly, to each person's stock proportionally. But to prevent stock being put in recently before such a consolidation, for the purpose of drawing the benefit of

it, no stock ought to have a share which has not lain for a certain time, for instance 6 months. When the surplus profit is regularly considerable, it is advisable to increase the stated interest.

The funds, whenever they amount to a certain sum, should be deposited in the public bank, in the name of two or more managers, as for be-hoof of the Establishment; not to be drawn except by their joint order, or that of their successors, on their death, resignation, or removal.

The Ruthwell Bank allows contributors of 56 years of age, if they incline, to draw payment in the form of an annuity of 10 *per cent.* on their dividends, provided the funds can afford so much. But perhaps it is better to allow contributors to purchase an annuity for themselves with their dividends. However, it is easily done if thought proper.

Mr Bone, above mentioned, established an office in London for receiving deposits, to be paid in annuities in old age; but it was given up, on account of the expense of supporting the establishment. At any rate, it seems hardly so advisable an establishment as a common Deposit-bank.

The general result to which the Committee have come is, that the best principle for the formation of a Savings Bank is an association or society of a few benevolent, intelligent, and respectable individuals of the parish, opening a bank upon the most simple terms, as analogous

as possible to an ordinary bank, for receiving the deposits of those who choose, and paying them upon demand, with interest.

With regard to the details of the execution of this plan, the Committee are disposed to recommend the course followed by the Edinburgh Bank, as extremely simple.

The terms of the bank are printed on slips of paper for circulation, as shortly expressed as possible, not occupying above 10 lines; mentioning the hour and place at which the bank is open each week; that no sum less than a shilling can be received; that interest at 4 *per cent.* is allowed; that repayment is made when desired; that interest is allowed only on sums amounting to 12s. 6d., or multiples of that sum; and that it is computed by months, as calculation by days on such small sums would be extremely troublesome, without any adequate advantage.

When a person pays in or draws out money, the transaction is marked on one of these slips, ruled on the back, stating the date; the sum in words, to prevent vitiation; and the sum in figures, for the convenience of addition; with the initials of the manager, as represented in the annexed slip. This slip is kept by the contributor as his voucher. The payment or draught is at the same time marked in a copy of the slip (without the sum in words, or initials of the manager), contained in a book, each page of which is ruled into three such slips, so as to afford an

exact copy of the voucher held by the contributor; the number of the page being marked on the voucher, for the sake of easy reference. The receipts and draughts of each day are at the same time marked in a cash-book, containing a Dr and Cr side, to show how the funds stand. In the country, a single person will be easily able to do the whole business of the parish for a week, in a single hour. In one or two banks, it is done by the clergyman, in his own house, or in the Session-house, on Saturday evening, during an hour after work, *e. g.* between half-past six and half-past seven. And it is understood, that the same is proposed in some other banks about to be established. In places of greater resort, more than one person may be necessary. In Edinburgh, three Directors are occupied; the first writing on the slip, the second in the slip-book, the third in the cash-book; by which arrangement a great deal of business is done in an hour.

The interest is easily computed; each 12s. 6d. yielding, at 4 *per cent.*, a half-penny per month.* At the end of the year, the interest and capital of each contributor are added together, and a

* Thus, in the annexed slip, 12s. 6d. have been paid by 29th August, which lie till 14th November, two full months, and yield 1d.; 12s. 6d. more have been paid by 26th September, which lie till 14th November, a full month, and yield $\frac{1}{2}$ d.; 1*l.* 5*s.* lie a full month from 14th November, and yield 1d.:—In all 2*½*d.

new receipt given him, for the accumulated sum, and a corresponding entry made in the books. †

The Committee have now submitted the result of their inquiries upon the point referred to them—the best mode of forming a bank for receiving the small deposits of labourers.

Loan Bank.—There is, however, an institution, analogous to a Deposit bank, which has been established in one or two places with advantage, and which the Committee think it right to mention. They allude to a *Loan Bank*, for giving small loans to labourers and others, for the relief of occasional distress, or accidental misfortune.

The Edinburgh Society, in their Second Report, mention, that it has often been found that an industrious family has been reduced to permanent beggary by an unforeseen misfortune, such as the death of a horse, or the like, from their having no means of putting themselves again in a situation to exert their industry. They notice, that with a view to remedy this, the celebrated Swift established a bank for small loans (Scott's Life of Swift, p. 480.) to be repaid by weekly instalments; they mention that several societies have been established in Ireland, for lending small sums to manufacturers and others in tem-

† Two shillings a-week, paid upon the terms of the Edinburgh Bank for 20 years, would amount to about 104*l.* of principal, and about 53*l.* of interest.

porary distress ; and that the Bath Society have established such a fund. After these examples, they have themselves established a similar fund ; and both they and the Bath Society have observed the most beneficial consequences. The Edinburgh Society give loans, not exceeding 5*l.*, to be repaid by weekly instalments of one shilling in the pound, for the relief of accidental misfortune ; where it can be shown that the loan will be really beneficial ; where there is a probable chance of repayment ; and upon finding a sufficient cautioner. They give no future loan if the borrower run four weeks in arrear, unless he give a satisfactory reason. They do not give a new loan until the expiration of a year from payment of the last instalment of the former one. They give no loan during the first year of marriage, or of commencing business. They take no interest. They only give four loans each day. They conduct this branch precisely in the same manner as the Deposit Bank ; with this difference only, that there is a short obligation at the head of the column in the receipt book, which is signed by the principal and cautioner. The Edinburgh Society have had most of their loans regularly and gratefully repaid ; and they have reason to believe, that some of the borrowers will pay into the Savings Bank, after the loan is cleared off, the few shillings which they have acquired the habit of accumulating weekly. But the Bank for loans is an establishment of a losing nature ; it is

not easily preserved from abuse ; and, though it may be beneficial in some of the larger towns, it seems in general better in the country to leave the occasional relief of this kind which may be proper, to the benevolence of landlords or masters.

Upon the whole, the Committee recommend the *Savings Bank* as an institution which cannot do harm; which must do good; † and which is so extremely simple in its nature, that it may with the greatest ease be established in every town and parish.

GEORGE TAIT, *Convener.*

EDINBURGH,
23. November, 1814. }

† The Second Report of the Edinburgh Society notices, as an incentive to induce the higher orders to exertion in forwarding any scheme likely to promote provident habits among the labouring classes, in addition to a regard for the welfare of those classes, that more than seven millions Sterling annually are understood to be levied for poor-rates in England.

Slip before referred to, p. 603 & 604.

A———. B———.

Labourer. 100, Cowgate.

Page 50.

		£	s.	d.	
1814.					
June 6.	Two shill.	-	2	..	C. D.
20.	Two shill.	-	2	..	C. D.
July 11.	One shill.	-	1	..	C. D.
25.	Two shill.	-	2	..	C. D.
Aug. 1.	One shill.	-	1	..	C. D.
8.	Two shill.	-	2	..	C. D.
22.	Two shill.	-	2	..	C. D.
29.	Two shill.	-	2	..	C. D.
Sept. 5.	Three shill.	-	3	..	C. D.
12.	Three shill.	-	3	..	C. D.
19.	Three shill.	-	3	..	C. D.
26.	Two shill.	-	2	..	C. D.
Oct. 3.	Three shill.	-	3	..	C. D.
10.	Three shill.	-	3	..	C. D.
17.	Three shill.	-	3	..	C. D.
24.	Three shill.	-	3	..	C. D.
31.	Four shill.	-	4	..	C. D.
Nov. 7.	Four shill.	-	4	..	C. D.
Paid 14.	One pound	-	2	5	..
		-	1	"	C. D.
21.	Four shill.	-	1	5	..
28.	Four shill.	-	4	..	C. D.
Dec. 5.	Five shill.	-	4	..	C. D.
12.	Five shill.	-	5	..	C. D.
19.	Five shill.	-	5	..	C. D.
26.	Five shill.	-	5	..	C. D.
Interest 31.	Twopence half-penny	-	..	2½	C. D.
	Carry over £	2	13	2½	

APPENDIX.

No. I.

List of EXISTING MEMBERS of the HIGHLAND SOCIETY of SCOTLAND, January 1816,

*Distinguishing the Dates of their Admission; with a List of the
Office-Bearers and Directors for that Year, annexed:*

The late Duke of Argyll was the Original President of the Society:—since his death, the Dukes of Atholl, Montrose, and Buccleuch, have successively held that Office.—By the Regulations, no Member can continue in the office of President more than four successive years.—Those marked thus * have been Vice-Presidents; two of whom are elected annually, and two go out by rotation.

*The following were declared Original Constituent Members of the
Society in 1784.*

- Most Noble the Marchioness of Stafford.
- * The Right Hon. John, Earl of Breadalbane:
The Right Hon. George, Earl of Glasgow.
- * The Right Hon. Robert Dundas of Arniston, now Lord Chief Baron
of His Majesty's Court of Exchequer.
- * Sir Ilay Campbell of Succoth, Bart.
- * The Right Hon. Sir John Sinclair of Ulbster, Bart:
Sir William Honyman of Armadale, Bart.
The Hon. Lord Bannatyne.
Sir William Forbes of Craigievar, Bart.
- Sir Alexander Muir Mackenzie of Delvin, Bart.
- Sir Benjamin Dunbar of Hempriggs, Bart.
- Sir John Macgregor Murray of Lanrick, Bart.
- Sir Eneas Mackintosh of Mackintosh, Bart.
- Sir Ewen Cameron of Fassfern, Bart.
- Donald Macleod, Esq. of Geanies, Sheriff of Ross-shire.

610 *List of Existing Members in January 1816.*

George Dempster, Esq. of Dunnichen.
James Grant, Esq. of Corymony, Advocate.
General Alexander Campbell of Monzie, M. P.
Lieut.-General Duncan Campbell of Lochnell, M. P.
Archibald Fletcher, Esq. Advocate.
James Ferrier, Esq. one of the principal Clerks of Session.
John Campbell, Esq. Clerk to the Signet.
Charles Gordon, Esq. of Pulrossie.
Patrick Macdougall, Esq. of Macdougall.
John Mackintosh, Esq. Royal-Bank.
Henry Mackenzie, Esq. Comptroller of Taxes.
Donald MacLachlan of Maclachlan esq. Sheriff of Argyllshire.
Francis Macnab of Macnab, Esq.
John Macniel, Esq. of Gigha.
Archibald Macneil, Esq. of Collonsay.
Dr Alexander Munro, Physician in Edinburgh.
James Horne, Esq. Writer to the Signet.
Lieut.-General Alexander Ross, Colonel of the 59th regiment.
John Clerk, Esq. of Elden, Advocate.
William Farquharson, Esq. of Monaltry.
Dr Adam Ferguson.
William Macfarlane, Esq. W. S.
Captain James Crawford of the Cumbraes cutter.
John Mackenzie, Esq. of Applecross.

1785.

* His Grace Jas. Duke of Montrose. John Campbell esq. W. S. now of
The Hon. Lord Hermand. London.
Alexander Maclean esq. of Coll.

27th July, 1787.

10th January, 1786.
* The Hon. Henry Erskine of A-
mondell.
George Skene esq. of Skene.
24th July, 1786.
* His Grace Alex. Duke of Gordon.
John Lamont of Lamont esq.
Eneas Robert Bruce Macleod esq.
of Cadboll.
Robert Stewart esq. of Garth.
James Fraser esq. of Belladrum.

Most Noble the Marquis of Stafford.
* The Right Hon. Lord Freder-
ick Campbell.
* Right Hon. the Earl of Rosslyn.
Sir John Campbell of Ardnamur-
chan, Bart.
Col. Alex. Robertson of Strowan.
Al. Hamilton esq. of Grange, Adv.
Alexander Keith esq. of Ravelston.
Kenneth Mackenzie esq. W. S.

8th January, 1788.

9th January, 1787.
Sir John Leslie of Findrassie and
Wardes, Bart.
John Francis Erskine esq. of Marr.
Jn Haggart esq. of Glendelvine Adv.

Sir Geo. Stewart of Grandtully, Bart.
Gen. Wm Wemyss of Wemyss MP.
Col. Alexander Macgregor Mur-
ray of Napier Ruskie.
The Hon. Lord Robertson.
John Buchanan esq. of Auchleslie.

List of Existing Members in January 1816. 611

25th July, 1788.

Lt.-Col. Thomas Kinloch of Kilrie.

18th January, 1789.

Archibald Campbell esq. of Jura.

Major-General Robert Campbell
of Kintarbert.

James Farquharson of Inverey esq.
Dr William Farquharson, physi-
cian, Edinburgh.

Norman Macdonald esq. of Barn-
isdale.

Alex. M'Alister esq. of Strathaird.

Lieut.-Col. Alexander Macdonald
of Lyndale.

1st August, 1789.

* His Grace John Duke of Atholl.
The Right Hon. James Earl of
Lauderdale.

Duncan Campbell esq. of Ross.
Gen. Andrew John Drummond of
Strathallan.

Major Colin Campbell of Balli-
veolan.

Colonel Allan M'Pherson of Blair-
gowrie.

Matthew Ross esq. Dean of the
Faculty of Advocates.

William Kerr esq. Secretary, Ge-
neral Post-Office of Scotland.

12th January, 1790.

* His Grace George D. of Argyll.
Alex. Brodie esq. of Arnhall.

Coll Macdonald esq. of Dalness,
W. S.

Lieut.-Col. James Spens, late of
the 78d regiment.

Hector Macdonald Buchanan esq.
of Ross, one of the principal
Clerks of Session.

11th January, 1791.

The Hon. Lord Craigie.
John Campbell esq. of South-hall.
James Lamont esq. of Knockdow.
John Macleod esq. of Colbecks.

Robert Allan esq. Banker in Edin-

8th July, 1791.

The Most Noble George, Marquis
of Huntly.

* The Right Hon. James, Earl of
Hopetoun.

Hon. Baron Sir John Stuart of
Fettercairn, Bart.

Major Hector M'Neil of Ugadale.

Major Gen. Sir Allan Cameron,
79th regiment.

10th January, 1792.

Col. Duncan M'Pherson of Cluny,
Right Hon. Sir William Drum-
mond of Logie-Almond.

Lt.-Gen. Wm. Robertson of Lude,
John Peter Grant esq. of Rothie-
murchus, M. P.

Right Hon. Arch. Colquhoun of
Killermont, his Majesty's Advo-
cate for Scotland.

John Campbell esq. Receiver Gen.
of the Customs in Scotland.

The Hon. Lord Succoth.

Thomas Hay esq. Edinburgh.

29th June, 1792.

George Drummond Home, esq. of
Blair-Drummond.

David Macdowall Grant esq. of
Arndilly.

Colin Mackenzie esq. of Portmore,
principal Clerk of Session.

8th January, 1793.

* The Right Hon. Francis, Earl of
Moray.

Right Hon. Charles Hope, Lord
President of the Court of Session.

Right Hon. Francis Lord Gray.

The Hon. Fletcher Norton, one of
the Barons of Exchequer.

Sir P. Murray of Ochtertyre, Bart.

Col. Donald Cameron of Lochiel.

George Paterson esq. of Castles-
Huntly.

612 List of Existing Members in January 1816.

Laurence Oliphant esq. of Gask.

Alex. Macdonell esq. of Glengary.
James Grant esq. W. S.

Alex. Maclean esq. of Ardgower.
Alexander Houston esq. of Clerk-

ington.
George Watson esq. Edinburgh.

Donald Maclean esq. W. S.
Capt. Alexander Macdonald, late

74th regiment.
John Cockburn Ross esq. of Shand-

wick.
Rev. Dr George Baird, Principal

of the University of Edinburgh,
Chaplain to the Society.

Robert Dundas esq. W. S.

1st June, 1793.
* The Right Hon. Archibald Earl

of Cassillis.
* Right Hon. Francis Earl of

Wemyss and March.
Sir John Hay of Haystown, Bart.

banker, Edinburgh.
Thos. Farquharson esq. of Howden.

Dr Andrew Coventry, Professor of

Agriculture, University of Edin-

Dougal Campbell esq. of Balinaby.
John Campbell esq. of Carsbrook,

W. S.
William Chisholm esq. of Chisholm.

14th January, 1794.
Right Hon. Walter, Earl of Airly.

Sir Arch. Dunbar of Northfield,
Bart.

John Lesly esq. of Balquhaine.
Humphrey Trafford Campbell esq.

of Askinish, Advocate.
Patrick Murray esq. of Simprim.

William Inglis esq. of Middleton,
W. S.

James Laidlaw esq. W. S.
John Syme esq. of Lochore.

29th June, 1794.
Charles Stewart esq. of Ardsheal.

James Baillie esq. of Coulterallers.

18th January, 1795.
Right Hon. Thomas, Earl of El-
gin and Kincardine.

James Dewar esq. of Vogrie.
Walter Watson esq. late of Bombay.

John Gordon esq. of Carleton.
John M'Ritchie esq. of Craigton.

22d June, 1795.
* The Right Hon. James, Earl of
Caithness.

James Mansfield esq. of Midmar.
James Scott esq. of Brotherton.

John Mill of Noranside esq.
Alexander Watson esq. of Turin.

Captain Neil Campbell of Dunstaff-
nage.

Thomas Crichton esq. Advocate.

13th January, 1796.
* The Right Hon. Alexander, Earl
of Leven and Melville.

* The Right Hon. Alexander Lord
Macdonald.

Major-General the Hon. Godfrey
Bosville.

Hon. Archibald Macdonald.
Sir George Abercromby of Birk-
enbog, Bart.

James Stirling esq. of Keir.
Hope Stewart esq. of Ballechin.

Francis Grant esq. of Kilgraston.
George Grant esq. of Burdsyards.

John M'Neil esq. younger of Gigha.
Capt. Alex. Macleod of Dalvey.

Archibald Lundie esq. W. S.
John Ferrier esq. W. S.

James Robertson esq. W. S.
James Donaldson esq. publisher of

the Edinburgh Advertiser.

4th July, 1796.
Right Hon. Earl of Kellie.
Sir James Hall of Dunglass, Bart.

John Sinclair esq. of Barrock.
R. Macdonald esq. of Staffa, Ad-

vocate, principal Secretary of
the Society.

List of Existing Members in January 1816. 613

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| James Raymond Johnston, esq. of Alva. | 9th January, 1798. |
| Major Charles Macvicar, late of the 42d regiment. | The Right Hon. Lord John Campbell, M. P. |
| John Forbes esq. of New, formerly of Bombay. | Sir Archibald Grant of Monymusk, Bart. |
| William C. Cunningham Graham esq. of Gartmore. | Captain Angus M'Donald of Mil-town. |
| Lieut.-Gen. Alexander Dirom of Mountannan. | Major Alex. Grant of the Madras Cavalry. |
| Lieut.-Gen. Simpson of Pitcorthie. | Jas Gordon esq. of Culvenan, one of the Commissioners of Edinburgh |
| Captain J. Dunbar, late of the 6th regiment of Dragoon Guards. | James Edmonston esq. of Newton. |
| George Greenlaw esq. of Hilton. | Patrick Nicholson esq. of Ardmore |
| John Young esq. of Cliesh. | Major Gen. David Dewar of Lath-allan. |
| Lt.-Col. Charles M'Quarrie, late of the 42d regiment. | Lieut.-Col. James Sinclair of Fersé. |
| | Robert Graham esq. W. S. |
| | Robert Menzies esq. W. S. one of the depute Clerks of Session. |
| | Donald Maclean esq. of Jeanfield, merchant, Edinburgh. |
| | Archibald Buchanan esq. Collector of Customs, Campbeltown. |
| | 2d July, 1798. |
| | * Right Hon. Lord Visc. Melville, First Lord of the Admiralty. |
| | Sir James Dalyell of Binns, Bart. |
| | James Macleod esq. of Rasay. |
| | Robert Nutter Campbell esq. of Kailzie. |
| | Robert Drummond esq. of Meg-ginch. |
| | Roderick Macniel esq. of Barra. |
| | Lieut.-Gen. Ilay Ferrier, Lt-Gov. of Dumbarton Castle. |
| | Theodore Morison esq. of Bognie. |
| | Henry Johnston esq. surgeon, Edinburgh. |
| | Alex. Forsyth esq. writer Edin. |
| | Andrew Watson esq. W. S. |
| | Captain Iver M'Milan of the Valentine Indiaman. |
| | Chas. Fraser esq. of Williamston. |
| | Thos. Smith esq. banker London. |
| | James Buchan esq. |
| | Isaac Hawkins Brown esq. honorary Member. |

614 *List of Existing Members in January 1816.*

8th January, 1799.

- * Most Noble the Marquis of Queensberry.
- * The Right Hon. the Earl of Morton.
- The Rt Hon. the Earl of Selkirk.
- The Hon. George Abercromby of Tullybody.
- Sir Michael Shaw Stewart of Greenock, Bart.
- Colonel Robert Anstruther, Edinburgh.
- Jas. Fergusson esq. of Pitfour, MP.
- Gilbert Innes esq. of Stow, Treasurer of the Society.
- Hugh Monro esq. of Teaninich.
- Murd. Mackenzie esq. of Ardross.
- John Mackenzie esq. of KinCraig.
- Wm Stewart esq. of Ardvorlich.
- Capt. Dug. Stewart of Balachulish.
- Dr Jas Home, Professor of Materia Medica in the Univer. of Edin.
- James Home esq. W. S.
- David Munro Binning esq. of Soft law, Advocate.
- Capt. Patrick Campbell of Inveraw.
- John Tait esq. W. S. Edinburgh.
- Captain Adam Fergusson, 58th regiment of foot.
- Captain Neil Macleod of Gesto.

1st July, 1799.

- * The Right Hon. Hugh, Earl of Eglinton.
- * The Rt Hon. Thos. Ld Dundas.
- The Hon. Ro. Lindsay of Leuchars.
- George Oswald esq. of Scotstown.
- James Sutherland esq. of Duffus.
- Lieut-Colonel Robert Macgregor Murray.
- John Smith esq. of Swimridgemuir.
- Jas. Pillans esq. merchant, Leith.
- Henry Jardine esq. W. S.
- Alex. Campbell esq. late of To bago.
- John Osburne Brown esq. WS. one of the Clerks of the Jury Court.
- John Craw esq. W. S.

Major John Gordon, residing at Drummin.

Lewis Gordon esq. Depute-Secretary of the Society.

Thomas Martin esq. Edinburgh.

John Tawse esq. Edinburgh.

Archibald Menzies esq.

14th January, 1800.

- * The Right Hon. the Earl of Haddington.
- General Sir Robert Abercromby of Airthry, G. C. B.
- General Sir Jas. Stewart Denholm of Coltness and West-Shields, B.
- John Campbell esq. of Lincoln's Inn.
- Alexander Marjoribanks esq. of Marjoribanks
- Al. Macleod esq. of Muiravonside.
- Simon Fraser esq. of Foyers.
- William Pagan esq. of Spittaltown.
- Crawford Tait esq. of Harvieston.
- George Tod esq. writer in Edin.
- John Fletcher esq. of Dunans.
- Major Pat. Macdougal of Soroba.
- Major Alex. M'Iver of Stornoway.
- James Chapman esq.
- James Shearer esq. Surveyor-Gen. Post-Office, Edinburgh.
- Pat. Stewart esq. of Achluncart.
- Geo. Douglas esq. Advocate, Sheriff of Kincardineshire.
- Alex. Maconochie esq. younger of Meadowbank, his Majesty's Solicitor-General for Scotland.
- Donald Macleod esq. of Talisker.
- Thomas Grierson esq. W. S.
- Francis Napier esq. W. S.

30th June, 1800.

- The Rt Hon. Erick, Lord Reay.
- Lieut-Colonel the Hon. Lawrence Dundas, M. P.
- Sir James Gordon of Letterfourie, Bart.
- George Baillie esq. of Jarviswood, M. P.

List of Existing Members in January 1816. 615

William Nisbet esq. of Dirleton.	William Grant esq. of Congalton.
Arch. Campbell esq. of Blythswood	Col. Js. Campbell, late of Madras.
Hercules Ross esq. of Rossie.	Col. Lud. Grant, late of Bengal.
Lewis Dunbar Brodie esq. of Bur-	Col. John Lamont younger of La-
gie.	mont.
William Caddel esq. of Banton.	Col. Alex. MacGregor Murray of
Thos. Adair esq. of Genoch, W.S.	the late Ceylon regiment.
Lieut-Col. John Lawrenson of In-	John Deas Thomson esq. of Norton.
vergathy.	Jn. Dunlop esq. of Morham-Mains.
John Dillon esq. Edinburgh.	William Fullerton esq. of Skehdon,
Joseph Gillon esq.	Advocate.
Duncan Cameron esq. younger of	Geo. Bruce esq. } Depute Clerks
Fassfern, W. S.	James Rose esq. } of Session.
And. Farquharson esq. of Breda.	Francis Ronaldson esq. surveyor,
Thomas Williamson esq. Leith.	General Post-Office, Edinburgh.
John Gillanders esq. of Hayfield.	William M'Kenzie esq. younger of
Jas. Herriot esq. of Ramornie, W.S.	Pitlundie.
Jas. Walker esq. wine merch. Leith	Major General Murray M'Gregor,
Robert Hill esq. of Firth, W. S.	Bengal Cavalry.
John Jeffery esq. of Allerbeck.	Lieut-Colonel Alexander Gordon,
Honourable Lord Balgray.	Sutherland Highlanders.
Archibald Swinton esq. W. S.	Captain George Gordon, late of
James Ferguson esq. of Crosshill,	the North Lowland Fencibles.
one of the Commissaries of Ed.	Alex. Paterson esq. of Thurso.
William Berry esq. younger of	
Tayfield, W. S.	
Charles Bremner esq. W. S.	29th June, 1801.
Rev. Dr John Stewart, minister of	Right Hon. Will. Dundas, M. P.
Luss, honorary member.	Sir Wm Bruce of Stenhouse, Bart.
Rev. Alex. Stewart, minister of	Sir James Montgomery of Stan-
Dingwall, honorary member.	hope, Bart. M. P.
	Colonel John Boyle of Shewalton.
13th January, 1801.	Lieut-General Andrew Dunlop of
* His Grace the Duke of Hamil-	Dunlop.
ton and Brandon.	Major-General Sir Tho. Brisbane
* His Grace the Duke of Buc-	of Brisbane.
cleuch and Queensberry.	Col. Andrew Macdowal of Logan.
Right Hon. Lord Montague.	Lieut-Colonel John Bannerman,
Sir G. S. Mackenzie of Coul, Bart.	late of Madras.
Sir Dav. Hunter Blair of Dunskey,	Alexander Stewart esq. younger
Bart.	of Balnakeilly.
Sir James Colquhoun of Luss, Bart.	John Stewart esq. of Crossmount.
Sir W. Fettes of Wamphey, Bart.	Robert Hawthorn Stewart esq. of
Sir George Buchan Hepburn of	Phisgill.
Smeaton, Bart.	John Hawthorn esq. of Castlewig.
Lieut-General A. Graham Stirling	Hugh Mair esq. of Wiseby.
of Duchray and Auchyle.	Wm. Graham esq. of Mossknows.
Ad. Rolland esq. of Gask, Advocate	John Murray esq. of Tundergarth.
	William Stewart esq. of Hillside.

616 List of Existing Members in January 1816.

John Bell esq. surgeon, Edinburgh.	Archibald M'Lean esq. of Penny-cross.
Major James Moodie of Melsetter.	Robert Brown esq. factor on the estate of Hamilton.
Cosmo Gordon esq. of the Customs, London.	Robert Proctor esq. W. S.
Colin Mackenzie esq. of Kilcoy.	Sir Js. Dunbar, Bart. Royal Navy.
Henry Clephane esq. W. S.	Jas. Macpherson esq. of Ardersier.
John Ogilvy esq. of Gairdoch.	Hen. Raeburn esq. portrait painter.
Robert Patrick esq. of Treehorn.	Alex. Mackenzie esq. agent for the British Linen Co. Inverness.
James Smith esq. merchant, Leith.	James Stewart esq. late merchant, Edinburgh.
Wm Kerr esq. merchant, Leith.	Arch. M'Ra esq. of Ardintoul.
Ad. White esq. merchant, Leith.	John Maclean esq. of Boreray.
Kirkpatrick Williamson Burnet esq. of Monboddo.	Duncan Campbell esq.
Mr John Moir, printer, Edinburgh.	Arch. Campbell esq. of Melford.
Al. Lang esq. younger of Overtown.	
Right Hon. Nicholas Vansittart, Chancellor of the Exchequer,	
Honorary Member.	

12th January, 1802.

Sir Hen. Stewart of Allanton, Bart.	Right Hon. the Earl of Hyndford.
Wm Fullerton esq. of Rosemount.	Sir Ro. Turing of Foveran, Bart.
James Graham esq. of Kinross.	Sir William Forbes of Pitsligo, Bart. banker in Edinburgh.
Hugh Innes esq. of Lochalsh, M.P.	J. H. Forbes esq. Advocate, Sheriff of Perthshire.
Duncan Monro esq. of Culcairn.	Henry Veitch esq. of Elliock, one of the Commissioners of the Customs.
Sir William Rae of Eskgrove, Bart. Sheriff of Edinburgh.	Charles Grant esq. of Waterish, M. P. for Inverness-shire.
Geo. Jos. Bell esq. Advocate.	John Dickson esq. of Coulter, Advocate.
William Fraser Tytler esq. of Ballinain, Sheriff of Inverness-shire.	Robert Hamilton esq. Advocate, Sheriff of Lanarkshire.
John Fraser esq. of Faraline, Advocate.	Sir Neil Menzies of Menzies, Bart.
Dr Andrew Mackenzie Grieve, Edinburgh.	Thomas Miller esq. younger of Glenlee.
Va. Hawthorn esq. Garthland, W.S.	Wm. Macdonald esq. of St Martins, Advocate.
Thomas Scott esq. W. S.	Ad. Maitland esq. of Dundrennan.
Rear-Admiral Alexander Fraser, Royal Navy.	John Callow esq. of Stapleton.
Lt-Col. Don. M'Neil, 91st Regt.	Wm. Grierson esq. of Rockhall.
Captain Will. Gordon, Minmore.	Wm. Molle esq. of Mains, W. S.
Colin Campbell esq. of Achnacroish.	Duncan Hunter esq. of London.
Rob. Gordon esq. late of Jamaica.	Maj-General Archibald Stewart of the Royals.
Robert Meldrum esq. of Clayton.	John Gordon esq. W. S.
T. Fairbairn esq. late of St Vincents Capt. Fr. Simpson, late of Bombay.	Robert Fraser esq. younger of Torbreck.
Robert Baillie esq. of Carphine.	
Major Dugald Campbell of Kilmartin.	

List of Existing Members in January 1816. 617

- Walter Ross esq. of Nigg.
Capt. John Rutherford of the 35th Regiment.
Hugh Hamilton esq. of Pinmore.
Robt. Campbell esq. of Sonochan.
- 12th January, 1803.
- * Rt. Hon. the Earl of Mansfield.
General the Hon. William Gordon of Fyvie.
Honourable Dudley Macdonald.
Sir Alexander Macdonald Lockhart of Lee and Carnwath, Bart.
General Richard Vyse.
Colonel Wm Francis Grant, M.P.
Major-General George Ainsley.
Jas. Douglas esq. of Orchardton.
Wm Gordon esq. of Campbletown.
Peter Johnston esq. of Cairnsallock
John Clerk esq. of Nunland.
David Macculloch esq. of Leaths.
Charles Granville Stewart Monteith esq. of Closeburn.
General Sir Paulus Emilius Irvine of Woodhouse, Bart.
Lieut-Colonel William Douglas, late of the 85th Regiment.
Capt. Vans Agnew of Sheuchan.
Richard Alexander Oswald esq. of Auchencruive.
J. Hunter Blair esq. of Dunskey.
Charles Stirling esq. of Kenmore.
Lieut-Colonel Benjamin Williamson of Marfield.
The Rev. Dr George Forbes, minister of Strathdon.
George Kinneir esq. banker in Edinburgh.
Robert Jamieson esq. W. S.
Alexander Miller Esq. of Monkcastle, Advocate.
J. H. Mackenzie esq. Sheriff of Linlithgowshire.
William Boswell esq. Sheriff of Berwickshire.
John Campbell esq. of Lochend.
Allan Cameron esq. factor for Lord Macdonald, North Uist.
- John Campbell esq. of Craignure.
Lachlan M'Kinnon esq. of Corrie.
George Brown esq. of Linkwood.
Peter Hill esq. bookseller, Edinr.
Patrick Warner esq. of Ardier.
Lieut-Col. James Macdonell of the 2d or Coldstream Regiment of Guards.
Humphry Graham esq. Edinburgh.
Duncan Stewart esq. Chamberlain of Kintyre.
James Maxwell esq. Chamberlain of Mull.
Malcolm M'Laurin esq. Oban.
Robert Campbell esq. Chamberlain of Roseneath.
Walter Moir esq. accountant Edinburgh.
- 27th June, 1803.
- Right Hon. Thomas, Viscount of Arbuthnott.
Lieut-General Right Hon. Lord Lynedock, G. C. B.
Hon. Douglas Gordon of Halyburton.
Marmaduke Constable Maxwell esq. of Nithsdale & Evringham.
Sir John Shaw Maxwell of Keochtrie and Netherlaw.
Major-General Sir William Maxwell of Monreith, Bart.
James Stewart esq. of Glaserton-House.
John Cathcart esq. of Genoch.
Colonel James Stevenson Barns of Kirkhill.
Lieut-Colonel Coll Macdonald of Morar.
Sir Patrick Walker, Advocate.
David Snodgrass Buchanan esq. of Blantyre Park, Advocate.
Jos. Stewart Menzies esq. of Foss.
Edmond Ferguson esq. of Baladmond.
Donald Macintyre esq.
Archibald Crawfurd esq. W. S.
John Campbell esq. of Auch.

618 *List of Existing Members in January 1816.*

- Captain John Campbell Kilmartin,
late 46th regiment.
Hugh M'Corquodale esq. of Liver-
pool.
Rev. Dr James Hall, Edinburgh.
Arch. Constable esq. bookseller,
Edinburgh.
William Ross esq. of Bridgbank.
Dr James Macniel of Stevenson.
James Bell esq. Leith.
John Mackenzie esq. Richmond-
Place.
William Mackenzie esq. W. S.
- Peter Campbell esq. of Kilmory.
Richard Lothian Ross, esq. of
Stafford.
William Hagart, esq. wine mer-
chant, Leith.
Niel Malcolm esq. of Poltalloch.
Dr Jo. Rogerson, physician to the
forces N. B.
Jo. Boyd esq. of Broadmeadows.
Dr Thomas Charles Hope, physi-
cian Edinburgh.
James Hope esq. W. S.
Walter Campbell esq. of Carra-
dale.
Col. Jo. Macleod of Unish, 78th
regiment.
Colonel Muir of Caldwell.
- 10th January, 1804.
- * The Most Noble the Marquis of
Douglas and Clydesdale.
Right Hon. William Earl of Errol.
* Lieut-Gen. Right Hon. the Earl
of Dalhousie, G. C. B.
* General the Right Hon. Earl of
Moira, Gov.-Gen. of Bengal.
* Right Hon. Lord James Murray.
Right Hon. Lord Binning.
Right Hon. Lord Rancliffe.
Right Hon. David Boyle, Lord
Justice Clerk.
Hon. Lord Polkemmett.
Sir George Warrander of Loch-
end, Bart. M. P.
General Alexander Don, Lieut.-
Governor of Gibraltar.
Major-Gen. Sir Wm Keir, Adj.-
General to the forces at Ceylon.
Captain Thomas Sheridan, 27th
regiment of foot.
Hugh Rose esq. of Kilravock.
George Gordon esq. of Hallhead.
Honourable Lord Pitmilly.
Col. William Bertram of Kerswell.
Hugh Mossman esq. Achtyfardle.
John Hamilton esq. of Sundrum.
George Paterson esq. younger of
Castlehuntly.
Thomas Hamilton Miller esq. Adv.
John Macdonald esq. of Borrodale.
Rev. Dr Robert Douglas, minister
of Galashiels.
- 2d July, 1804.
- Right Hon. William Arbuthnot,
Lord Provost of the City of E-
dinburgh.
Gen. Wm Maxwell of Parkhill.
Lieut-Col. Richard William How-
ard Vyse, M. P.
Dr Rutherford, physician and Pro-
fessor of Botany, University of
Edinburgh.
Robert William Duff esq. of Fet-
teresso.
Peter Speirs esq. of Culcroich.
Lieut-Col. Robert Cameron, late
of Madras.
Lieut-Col. Robert Campbell Ha-
milton of Milburn and Dalserf.
Andrew Murray esq. younger of
Murrayshall, Advocate.
James Farquhar Gordon esq. W.S.
Geo. Bell esq. surgeon Edinburgh.
Alex. Low esq. of Woodend.
Jas. Campbell esq. of Dunmore.
James Connell esq.
Francis Short esq. of Courance.
Michael Lanning esq. of Colzium,
W. S.
William Macleod esq. of Luskin-
tyre.
William Gordon Macrae esq.

List of Existing Members in January 1816. 619

Jo. Proctor esq.	James Cathcart esq. merch. Leith.
James Watson esq. factor to Lord Dundas.	Captain Hugh Stevenson, late Argyleshire militia.
John Rae esq.	Alexander Mundell esq. solicitor, London.
John Menzies esq. cashier to the Duke of Gordon.	William Patrick esq. W. S.
James Mackay esq. goldsmith and jeweller Edinburgh, the Society's jeweller and medalist.	Robert Rattray esq. W. S.
William Wilson esq. factor for the Earl of Glasgow.	Alex. Stewart esq. of Darculich.
David Mutrie esq. merchant in Glasgow.	James Law esq. Edinburgh.
Alex. Campbell esq. Greenock.	
Joseph Gordon esq. of Carroll, W.S.	
<i>8th January, 1805.</i>	
The Right Hon. Flora, Countess of Loudon and Moira.	Right Hon. George, Earl of Aberdeen.
Right Hon. the Earl of Fife.	Sir Alex. Gordon of Culvenan.
The Hon. William Ramsay Maule of Panmure, M. P.	James Macdonald esq. of Langdale, M. P.
Sir And. Cathcart of Carlton, Bart.	Major-Gen. Lachlan M'Quarrie, of Jarvisfield, Governor of New South Wales.
Sir George Montgomery of Macbiehill, Bart.	Major Thomas Hart, Ballencrieff.
Alexander Irvine Forbes esq. of Chivas, Advocate.	John Anstruther esq. of Ardett, Sheriff of Fifeshire.
Alexander Moir esq. of Scotstown, Sheriff of Aberdeenshire.	Patrick Small Keir esq. of Kinmonth, Advocate.
John Rogerson, M.D. physician to the Court of St Petersburgh.	Richard Wharton Duff esq. Comptroller of Excise.
Henry Glasford esq. of Dugalstone Major-Gen. Sir Thomas Dallas.	John Buchanan esq. of Ardoch.
Lieut-Col. David Robertson MacDonald of Kinlochmoidart.	Alex. Mackenzie esq. of Scotsburn.
Sir James Ferguson of Kilkerran, Bart.	Richard Graham esq. of Blatewood
Kenneth Mackay esq. of Torboll.	Dugald Campbell esq. of Illandrie.
Alexander Fraser esq. of Inch Coulter.	John Gregorson esq. of Ardtornish
Jas. Forrest esq. of Commiestone.	A. C. Younger esq. of Ardyne.
Alexander Osburn esq. one of the Commissioners of the Customs.	John Ferguson esq.
David Ewart esq. of Craiginvie.	Edward Lothian esq. Advocate.
John Niven esq. of Thornton.	John Kerr esq. of Stonypath, W.S.
Henry Niven Lumsden esq. of Auchindoir.	William Keyden esq. W. S.
William Campbell esq. W. S.	James Scott esq. of Stonemurphie, W. S.
	Cosmo Falconer esq. Edinburgh.
	Thomas M'Ritchie esq. merchant Edinburgh.
	Andrew Bogle esq. secretary Royal Bank of Scotland.
	Alexander Bonthorne esq.
	Gilbert Bertram esq. merch. Leith.
	Wm Bertram esq. merch. Leith.
	Alexander Goalen esq. of Leith.
	James Wilson esq. of Jamaica.

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14th January, 1806.

- His Royal Highness the Duke of Sussex.
 Right Hon. the Earl of Roseberry.
 Right Hon. Lord Glenbervie.
 Sir John Hope of Craighall, Bart.
 Sir Thomas Gibson Carmichael of Skirling, Bart.
 Colonel Elliot Lockhart of Borthwickbrae, M. P.
 Major-General Keith M'Alister of Loup.
 Robert Stewart esq. of Fincastle.
 Lieut Colonel George Callander of Craigforth.
 Major Donald Campbell of Knock.
 Ro. Hepburn esq. of Clerkington.
 J. Wolfe Murray esq. Advocate
 Judge of the High Court of Admiralty.
 William Murray esq. of Polmaise.
 James Hare esq. of Calderhall.
 Patrick Miller esq. of Dalswinton.
 Archibald M'Nab younger of M'Nab esq.
 Gilbert Young esq. of Youngfield,
 Depute Commissary General for Scotland.
 Colin M'Lachlan esq. merchant,
 Glasgow.
 Alex. Ramsay esq. of Demerary.
 James Fyffe esq. of Smithfield.
 John Russel esq. W. S. one of the Clerks of the Jury Court.
 John Muir esq. }
 Wm Gilchrist esq. } merchants, E-
 John White esq. } dinburgh.
 James P. Inglis esq.
 Henry Raeburn esq.
 Major James M'Vean, 78th Regt.
 The Right Hon. George Rose,
 Treasurer of the Navy, M. P.
 Honorary Member.

30th June, 1806.

- Right Hon. the Earl of Kinnoul.
 Honourable Charles Douglas.
 Sir Gilbert Stirling of Rosehall,
 Bart.

Right Hon. Robert Liston of Listonshiel, Ambassador to the Ottoman Porte.

John Norman M'Leod esq. of M'Leod.

John Menzies esq. of Pitfoddells.

George M'Pherson Grant esq. of Ballindalloch.

James Glasford esq. Advocate.

James Pringle esq. of Torwoodlee.

Gilbert Bethune esq. of Balfour.

Charles S. M'Alister esq. of Loup and Kennox.

Duncan Darroch esq. of Gourock.

Gordon Cameron esq. of Letterfindlay.

James L'Amy esq. of Dunkenny, Advocate.

Js. Keay esq. of Snago, Advocate,
 Dun. M'Farlane esq. of Glenralloch, Advocate.

Jn. Prescot esq. of St Petersburgh.

Michie Forbes esq. of the house of Forbes & Co. Bombay.

Robert Ainslie esq. W. S.

John Patison esq. W. S.

Ran. Macdonald esq. of Borinish,
 James Fouler esq. of Fortrose, formerly of Jamaica.

Andrew Halliday esq. M. D.

Major Ludovick Stewart, 24th Regiment of Foot.

Captain Alex. Campbell late of the Scots Greys.

Alexander Gillespie esq. surgeon, Edinburgh.

Robert Wilson esq. accountant, Edinburgh—the Society's Auditor of Accounts.

James Gillespie esq., Architect to his Royal Highness the Prince Regent.

John Johnston esq. landsurveyor.

13th January, 1807.

- * Gen. Right Hon. Earl Cathcart.
 Right Hon. Lord Archibald Hamilton, M. P.

List of Existing Members in January 1816. 621

- Right Hon. Lord Ogilvie.
Sir Charles Edmonstone of Dun-
treath, M. P. for Stirlingshire.
Ranald George Macdonald esq. of
Clanranald, M. P.
Lieut.-General Robert Stewart of
Raitt.
Lt-Gen. Matthew Baillie of Cairn-
broe.
John Gordon esq. of Cluny.
Roderick Macleod esq. younger,
Cadboll.
John Colquhoun esq. Sheriff of
Dunbartonshire.
William Douglas esq. junior of
Orchardton, M. P.
Adam Ferguson esq. of Woodhill,
Advocate.
Dr Alex. Monro junior, Professor
of Anatomy in the University of
Edinburgh.
Archibald Graham Campbell esq.
of Shervan.
Robert Campbell esq. of Ardchat-
tan.
Joseph Williamson esq., Principal
Clerk of Teinds.
Alex. Mackenzie esq. of Hilton.
John Gordon esq. of Swinzie.
John Brown esq. of Coultermains.
William Grant esq. of Seabank.
Colin Thomson esq. of St Kitts.
Ewan MacLachlan esq. of Killimore,
Mull.
Walter Dickson esq. merchant in
Edinburgh.
Elphinstone Balfour esq. bookseller
Edinburgh.
Robert Stevenson esq. engineer of
Northern Lights.
James Bristow Fraser esq. writer
in Edinburgh.
William Rae Wilson esq. of Kel-
vinbank.
Alexander Macdonald esq. of Del-
halay.
Robert Bruce esq. of Symbister,
Zetland.
- William Mowat esq. younger of
Arnisbrae, Zetland.
29th June, 1807.
Right Hon. the Earl of Galloway.
Right Hon. Lord Blantyre.
Robert Hay esq. of Spott.
Samuel Anderson esq. of Rouches-
ter, banker, Edinburgh.
Maj-General John Macintyre of
the Hon. East India Company's
Service.
James Forbes esq. of Kingerloch.
Alex. Campbell esq. of Ederline.
John Fullerton esq. of Kilmichael.
Thomas Thomson esq. Advocate.
Jn. Graham Dalyell esq. Advocate.
Norman Hill esq. of Brownhills,
Advocate.
Daniel Vere esq. of Stonebyres,
Advocate.
Col. Js. Cunningham of Fearnness.
John Wardrop esq. banker, Edin-
burgh.
David Falconer esq. of Carlourie.
Lieut-Colonel Alexander Camp-
bell of Ballochyle.
Capt. James Macalister of Spring-
bank, 13th Dragoons.
Claud Russell esq. accountant E-
dinburgh.
James Hamilton esq. of Kames,
W. S.
Thomas Wright esq. of Glennie.
James Adam esq. of Burnfoot,
factor on the estate of Perth.
James Hill esq. of Glasgow.
Wm Braidwood, jun. esq. manager
of the Marine Insurance Co.
- 12th January, 1808.*
Sir James Riddell of Sunart, Bart.
Sir Wm Gordon Cumming Gordon
of Altyre and Gordonstone, Bart.
James Vashon esq. Vice-Admiral
of the Red.
Lieut-Col. Evan John Macgregor
Murray of Glencairnaig, Adj.-

622 List of Existing Members in January 1816.

General to the King's troops at Madras.	John Farquharson esq. of Haughton.
Thomas Knox esq. son of the Hon. Mr Knox, M. P. for the county of Tyrone.	Lieut-Col. John Mackintosh of the Royal Marines.
Forbes Hunter Blair esq. banker, Edinburgh.	Rear-Admiral David Milne of the Royal Navy.
John Campbell esq. of Stonefield.	Sir Gregor Macgregor.
James Erskine esq. of Cambus.	James Harrower esq. younger of Enzievar, Advocate.
Thomas Mackenzie esq. younger of Applecross.	George Tait esq. Advocate.
Dr Andrew Duncan, jun. M. D. Edinburgh.	Capt. Alex. Stewart of Strathgary.
Benj. Hawes esq. of Old-Barge-stairs, Blackfriars, London.	Chalmers Izett esq. of Kinnaird.
William Francis Hunter esq. of Barjarg.	Patrick Neil esq. Edinburgh.
Charles Campbell esq. of Combie.	Alex. Laing esq. architect Edin.
Alexander Brebner esq. of Learney.	Rev. William Singers, D. D. minister of Kirkpatrick-juxta.
Colin Macdougal esq. of Lunga.	
Sutherland Mackenzie esq. merchant Leith.	
Thos. Mitchell esq. of Rosebank.	10th January, 1809.
Colin McLarty esq. of Chesterville, Jamaica.	Most Noble George, Marquis of Tweeddale.
Archibald Campbell esq. of Drum-sainy.	Lieut-Gen. the Hon. John Leslie.
Charles M'Alister Shannon esq. of Levenstrath.	Lt-Col. the Hon. Chas. Cathcart.
James Bremner esq. Solicitor of Stamp duties.	Vice-Admiral of the White, Sir Edmond Nagle.
Hen. Monteith esq. of Monkland.	Hon. Lord Gillies.
	Robert Stewart esq. of Alderstone.
	Henry Hume Drummond esq. younger of Blair-Drummond, Advocate.
	John Stewart esq. of Binny.
	Chas. Hamilton esq. of Fairholm.
	Rose Campbell esq.
	Hugh Maclean esq. yo. of Coll.
	John Campbell esq. } Merchants
	John Mackenzie esq. } Leith.
	Jas. Greig esq. of Maukinlee, WS.
	Ro. M'Millan esq. of Polbae, WS.
	William Davidson esq. younger of Hatton.
	Samuel Stirling esq. younger of Glorat, Advocate.
	William Howieson Crawford esq. of Craufordland.
	William M'Night Crawford esq. of Ratho.
	Masterton Robertson esq. of Inch-
	es, Advocate.
	John Burnet esq. of Kemnay.

27th June, 1808.

His Grace the Duke of Roxburgh.
Right Hon. the Earl of Minto.
Right Hon. Lord Robert Kerr.
Hon. P. R. Drummond Burrell, M. P.
Major Alexander Mackay, 93d regiment.
Fred. Fotheringham esq. one of the Commissioners of Excise.
Alex. Gordon esq. late Capt. 15th Light Dragoons.
Major Colin Mackay of the 78th regiment.

List of Existing Members in January 1816. 623

William Ogilvy esq. younger of Chesters, Advocate.	Henry Davidson esq. Haddington
John Campbell esq. of Achawilling	Geo. M'Andrew esq. at Torrick.
Charles Stewart esq. of Dalguise.	David Mathie esq. Glasgow.
Brigade-Major Howard.	Colin Macnab esq. merch. Grangemouth.
Alexander Keith esq. of Corstorphinehill.	James M'Alpine esq. merchant Strachur.
John Pollock esq. W. S.	Captain William Fraser, residing at Brackla.
Henry Dundas Beatson esq.	Alexander Falconer esq. Nairnside
Duncan M'Kellar esq. merchant Glasgow.	Captain John Stewart of the Prince of Wales Excise yacht.
John Forman esq. W. S.	

26th June, 1809.

Dame Ann Preston Campbell of Fernton, Lady Baird.
* Right Hon. Alex. Lord Elibank.
Hon. Alex. Murray of Elibank.
Sir David Davidson of Cantray.
John Harvey esq. of Ickwell, Bury, and Tiningly Park, Yorkshire.
William Stewart esq. younger of Garth.
Allen Stewart esq. of Bonrannoch.
John Stewart esq. of Shierglass.
John Campbell esq. of Borland.
George Lyon esq. of Ogle.
David Blair esq. of Cookston.
Lt-Col. George Maxwell, younger of Carruchan.
John Robert Irving esq. of Bonshaw, Advocate.
George Robinson esq. of Clermont, W. S.
Rev. Rob. Rennie, D. D. Kilsyth.
Donald Fletcher esq. of Bernice.
Thos. Harkness esq. of Bailliemore.
Wm Aitchison esq. of Drummore.
David Thomson esq. W. S.
George Munro esq. of Culrain.
John Murray esq. of Conland.
John Philips esq. W. S.
Dr Peter MacLachlan.
Richard Mackenzie esq. W. S.
Francis Wilson esq. W. S.
John Govan esq. W. S.
John Macpherson esq. Chamberlain to Ld Macdonald in Sky.

9th January, 1810.

Right Hon. the Earl of Fingal.
Right Hon. James, Lord Ruthven.
Right Hon. Lord Ashburton.
Hon. Frederick Sylvester North Douglas of Glenbervie, M. P.
Archibald Spiers esq. of Elderslie, M. P.
Alexander Munro esq.
Claud Alexander esq. of Ballamyle.
William Campbell esq. of Netherplace.
William Somerville esq. of Somercastle.
Alex. Cooper esq. of Smithstown.
Arch. Campbell esq. of Catrinebank.
Duncan Campbell esq. of Barcadine.
Alex. Young esq. of Harburn, WS.
Chas. Selkirk esq. accountant Edin.
John Swinton esq. Broadmeadows.
John McCulloch esq. of Barholm.
James Murray Grant esq. of Glenmoriston.
Alex. Grant esq. of Jamaica, Representative in the Hon. House of Assembly for the town and parish of Port-Royal.
Thomas Rennie Strachan esq. of Tarrie.
Duncan Cowan esq. mercht. Edin.
Alex. Cowan esq. merchant Edin.
William Dickson Watson esq.
John Hepburn esq. of Colquhazie,

624 *List of Existing Members in January 1816.*

Captain Alexander Macdonald,	James Drummond esq. M. P. for Royal Horse Artillery.
Archibald Campbell esq. of Askon-	mel, Royal Artillery.
Anthony Murray esq. of Crieff.	Colonel Sir Alex. Leith, younger of Freefield.
Michael M'Millan esq. merchant Glasgow.	John Gordon esq. of Cairnbulg.
William Johnstone esq. of Hol- meadow.	William Calder esq. merch. Edin. Geo Garden Robinson esq. Banff.
Jn Clapperton esq. mercht. Edin.	William Buchanan esq. Cadogan Place, London.
Eneas Falconer esq. Blackhills, Nairnshire.	Kenneth Francis Mackenzie esq. Robert Buchanan esq. Glasgow.
Andrew Bennet esq. of Muckraw.	Capt. Charles Gregorie, 6th Dra- goon Guards.
William Smith esq. M. P. for Nor- wich, Honorary Member.	Thomas Palliser esq. factor to his Grace the Duke of Atholl.
<i>2d July, 1810.</i>	
Sir John Pringle of Stitchell, Bart.	Capt. Archibald Campbell, Cham- berlain to his Grace the Duke of Argyll.
Sir David Maxwell of Cardoness, Bart.	Basil Robertson esq. of Gofsburgh, Shetland.
Alex. Boswell esq. of Auchinleck.	Cha. Knowles Robinson esq. W.S. James Stewart Robertson esq. of Edradynate.
James Urquhart esq. of Meldrum, Sheriff of Banffshire.	Alex. Macleod esq. of Canada. William Henderson esq. merchant, Edinburgh.
George Harley Drummond esq. of Drumtochty, M. P.	Thomas Megget esq. W. S. Captain Alexander Macdonald of the 76th Regiment.
Robert Barclay Allardice esq. of Urie.	Peter Couper esq. W. S. Mr John Thomson, bookseller, E- dinburgh.
Wm Cunningham esq. of Lainshaw.	
Col. Arch. Moore, Vice-Lieut. and Col. of the Buteshire Loc. militia	
Lieut-Col. Alexander Campbell of Poss hill, Lanarkshire.	
Walter Williamson esq. of Card- rona.	
Robert Clark esq. of Comry.	
Robert Watt esq. of Luggiebank.	
David George Sandeman esq. of Springland, Perthshire.	
Colin Campbell esq. merch. Glasg.	
The Rev. G. J. Hamilton, minister of Ashkirk.	
Captain James Laskey, Galloway militia.	
Wm M'Dowall esq. of Woolmet.	
<i>8th January, 1811.</i>	
Right Hon. John Lord Cawdor.	1st July, 1811.
Henry David Erskine esq. younger of Amondell.	Right Hon. Lord Linton. The Hon. Col. Hugh Arbuthnott. John Hay esq. younger of Smith- field and Hayston, Advocate. Murdoch M'Laine esq. of Loch- buy.
	William Alexander Mackinnon of Mackinnon, esq.
	William Sinclair esq. of Freswick. John Macdonald esq. of Sanda. Alex. Macduff esq. of Bonhard. John Harvey esq. } writers to the John Murray esq. } signet.

List of Existing Members in January 1816. 625

14th January, 1812.

- The Honourable Baron Clerk.
Sir George Clerk of Pennycook,
Bart. M. P.
Sir John Anstruther of Anstru-
ther, Bart. M. P.
Lieut-General Sir David Baird of
Ferntoun, Bart. G. C. B.
George Sinclair esq. younger of
Ulster.
Gen. Alexander Hay of Rannes.
John Livingston Campbell esq. of
Achallader.
John Dunmore Napier esq. of Bal-
lochinrain.
John Spottiswood esq. of Spottis-
wood, solicitor, London.
Arthur Nicholson esq. of Lochend.
John Borthwick esq. younger of
Crookston, Advocate.
Anthony Maxton esq. of Culto-
quhey.
Nicol Allan esq. Manager of the
Hercules Insurance Company.
Æneas MacBean esq. W. S.
James Macdonell esq. younger of
Milnefield, W. S.
James Wyld esq. merchant, Leith.
James Robertson esq. iron-monger,
Edinburgh.
James M'Innes esq. writer, Edinr.
Tho. Johnston esq. writer, Edinr.
Thomas Trotter esq.
Right Hon. the Lord Bishop of
Meath, of the Kingdom of Ire-
land, *Honorary Member.*

29th June, 1812.

- * Most Noble the Marquis of Lo-
thian.
Sir Alex. Campbell, Bart. of Abe-
ruchill.
James Hunter esq. of Thurston.
John Maitland esq. of Eccles.
J. F. Kennedy esq. younger of Du-
nure.
William Niven esq. of Achalton
and Kirkbride.

VOL. IV.

- Hu. Hutchison esq. of Southfield/
John Playfair esq. Professor of Na-
tural Philosophy in the Univer-
sity of Edinburgh.
Wm. Hunter esq. of Ormistoun;
James Crichton esq. of Friarscares.
John Donaldson esq. of Kilphain,
W. S.
Forrest Dewar esq. surgeon, E-
dinburgh.
William Harley esq. of Glasgow.
Hector Frederick M'Neill esq. of
Gollychilly.
David Stewart Galbreath esq. of
Lochsanish.
John Fraser esq. cashier, Castle-
Grant.
Robert Morton esq. jeweller in E-
dinburgh.
Thomas Deuchar esq. Shielhill,
Forfarshire.

12th January, 1813.

- Sir Alex Ramsay of Balmain, bart.
Major-General William Burnet of
Banchory Lodge.
William Nairne esq. Assistant In-
spector General of Barracks.
Patrick Maxwell Stewart esq.
John Buchan Hepburn esq. of
Letham.
Edward Boyd esq. of Mertonhall.
William Mackintosh esq. of Mill-
bank.
James Carnegie esq. of Balnamoon.
Dugald Campbell esq. of Kildaloi:
Lieut-Colonel David Rattray, 63d
Regiment.
Major John Grant of Achterblair.
Rob. Lawson esq. of Ballimore.
Capt. Alex. Cumming of Docharn.
Dr James Bayne, physician in
Grantown.
Geo. MacDougall esq. Edinburgh.
Thomas Eddington esq. merchant,
Glasgow.
John Mackenzie esq. writer, Edin-
burgh.

R r

626 *List of Existing Members in January 1816.*

Rev. William Gillespie, minister of Kells.

Mr — Hope, residing at Glenlee.
David Lowson esq. town clerk of Arbroath.

28th June, 1813.

* **Right Hon. George Granville, Earl Gower, M. P.**

* **Right Hon. Archibald Lord Douglas of Douglas.**

Jn. Wauchope esq. of Edmonstone
Alexander Leith esq. of Freefield.

Robert Dalrymple Horne Elphinstone esq. of Logic-Elphinston.

John Ramsay esq. of Barra, Aberdeenshire.

James Hay esq. of Monkhill.
Walter Bigham Laurie Esq. of

Redcastle, Kirkcudbright.
Patrick Stirling esq. younger of Kippendavie.

Geo. Scott Elliot esq. of Lauriston.
George Reid esq. of Rathobank.

Adam Duff esq. Advocate, Sheriff of Forfarshire.

William Horne esq. younger of Stircock, Advocate, Sheriff of Haddingtonshire.

William Macdonald esq. of Calley-Strathardle, Perthshire.

James Grant esq. of Bucht, present Provost of Inverness.

Tho. Gilzean esq. of Bunachton, some time Provost of Inverness.

John Brander esq. of Pitgavenny.
William Young esq. of Inverougie.

Patrick Seller esq. younger of Westfield.

Andrew Christie esq. of Ferrybank.

Dr Henry M'Laggan, Fellow of the Royal College of Physicians, Edinburgh.

George Ramsay esq. residing at Deanhouse.

James Wingate esq. of Westshields.

Geo. Irving esq. merchant, London:

Robert Johnston esq. merchant, Edinburgh.

Alex. Henderson esq. merchant, Edinburgh.

John Reid esq. merchant, Leith.

Cha. Olyphant esq. } writers to the

William Bell esq. } signet.

James Swan esq.

John Arch. Campbell esq. W. S.

James Gordon esq. Paymaster 92d Regt. or Gordon Highlanders.

Alexander Stevenson esq. writer, Edinburgh.

Dr Robert Burt, Edinburgh.

Major Alexander Mackay of Laggan, Argyleshire.

Jn. Fullerton esq. late of Jamaica.

Rev. James Bryce, late minister of Strachan.

Mr Jas. Canning, residing at Shiels, Kirkcudbright.

11th January, 1814.

Right Hon. Lord Berridale.

Major-Gen. the Hon. Alex. Duff.
Sir John Marjoribanks of Lees,

Bart. M. P.

Kirkman Finlay esq. M. P. for Glasgow, &c.

Charles Forbes esq. of Edinglassie, M. P. for Beverley.

James Sedgwick esq.

John Stirling esq. of Kippendavie.

Thomas Graham Stirling esq. of Airth.

William Mackintosh esq. of Ballinsepick.

Major Alexander Francis Taylor, Rothiemay house.

Major Charles Macpherson, Inspector-General of Barracks for Scotland.

Major Robert Macdonald, Royal Horse Artillery.

Garden Duff esq. of Hatton.

John Gordon esq. of Aitkenhead.

Alexander Campbell esq. of Half yards.

List of Existing Members in January 1816. 629

Wm Trotter esq.	} merchants in Edinr.	George Nelson esq. factor on the estate of Kames, Bute.
Wm Galloway esq.		
John Mill esq.		
Thomas Allan esq. banker in Edin.		10th January. 1815.
James Grierson esq. of Dalgonet.		Walter Scott esq. of Abbotsford.
George Miller esq. of Frankfield.		James Rose esq. one of the Com- missioners of Excise.
George Meek esq. of Campfield.		Arch. Farquharson esq. of Finzean
John Learmonth esq. merch. Edin.		William Ramsay esq. banker Edin.
Ro. William Hamilton esq. mer- chant, Leith.		Robert Jameson esq. Advocate.
Captain Dugald Macdougal of the Tigris East Indiaman.		George Wood esq. surgeon Edin.
Captain John Cheape, Edinburgh.		George Burnet esq. St Andrew's square, Edinburgh.
Captain Hugh Macgregor of the 91st regiment.		John Pitcairn esq. younger of Pit- cairn.
Robert Gordon esq. Croughlie, Banffshire.		John Bowie esq. of Cambisican.
Ro. Wight esq. accountant Edin.		John Baird esq. of the Shotts Iron Works.
2d July, 1814.		
The Right Hon. Charles Abbot, Speaker of the House of Com- mons, Honorary Member.		Rev. John M'Kinnon, minister of Slate.
Michael Stewart Nicholson esq. younger of Carnock.		Mr John Elder, merchant, Slate.
Angus Mackintosh esq. of Holm.		Mr Alexander Laing, residing at Edmonstone.
Robert Downie esq. of Dumbarrow		Mr Wm Sibbald, architect, Edin.
Thomas Morison esq. of Elsick, M. D.		Mr James Brown, do. do.
Charles Alexander Graham esq. younger of Leckie.		Mr James Allen, } merchants
Jas Eddington esq. of Gargunnock.		Mr Arthur Pollock } Grangemouth
Lachlan Mackintosh esq. of Raig- more.		
William Tait esq. of Pirn.		3d July, 1815.
Captain John Boswell Donaldson of Wairdie, R. N.		Field Marshal His Grace Arthur, Duke of Wellington, Honorary Member.
David Dick esq. of Glensheal.		Field Marshal Prince Blucher, Honorary Member.
John Carfrae esq. of Glenboig.		Most Noble the Marquis of Bute.
Dugald Macdougall esq. of Galla- nich.		Lieut-General Right Hon. Lord Niddry, G. C. B.
William Don esq. banker in Forfar, and Lt-Col. of the centre regt. of Forfarshire Local militia.		Sir Thomas Livingstone of West- Quarter, Bart.
The Rev. George Craig Buchanan of Mackeanston.		Stewart Menzies esq. of Culdairs.
James Caird esq. of Drumfad, Writer in Stranraer.		William Napier esq. of Blackstone.
		Col. David Stewart, Garth.
		Norman Lockhart esq. W. S.
		James M'Nair esq. of Glasgow.
		John Henry esq. of Corse.
		Wm Cochran esq. of Ladyland.
		Alex. Robertson esq. of Hallcraig;
		Col. Hon. E. India Co.'s service.

628 *List of Existing Members in January 1816.*

John Innes Crawford esq. of Bell-field, Cleghorn-house, Lanarkshire.	Jn Tait esq. younger of Pirn, W.S. George Wigham esq. of Halliday-hill, Dumfries-shire.
Duncan Shaw esq. factor to Clanranald.	Dr Francis Buchanan, late of India Dr Henry Dewar, Fellow of the Royal College of Physicians, Edinburgh.
9th January, 1816.	
The Hon. Lady Hood Mackenzie of Seaforth.	Patrick Robertson esq. Advocate.
Right Hon. Lord Belhaven and Stenton.	James Saunders Robertson esq. W. S.
Right Hon. William Adam, Lord Chief Commissioner of the Jury Court.	William Fraser esq. younger of Glennaird, W. S.
Admiral the Hon. Sir Alexander Cochran, G.C. B. of Murdiston, Lanarkshire.	Charles James Fox Orr esq. of Thornly Park, W. S.
Sir James Dalrymple Hay of Park-place, Bart.	Ro. Kerr esq. surgeon, Portobello.
Jas Hope Vere esq. of Craighall.	Captain Charles Grant, Tombreck-achie, Banffshire.
John White Melville esq. of Strath-kinness.	John Young esq. George Street.
John Shaw Stewart esq. son of Sir M. Shaw Stewart, Bart.	Mr David Willison, printer, Edinburgh. Thomas Beveridge esq. } Edinr. Donald M'Intosh esq. } Captain Simon Fraser, Knocky, Inverness-shire.

Number of existing Meinbers, January 1816,
Eleven Hundred and Nine.

No. II.

No. II.

LIST OF PRESIDENT, VICE-PRESIDENTS, AND OTHER OFFICE-BEARERS, AND OF THE DIRECTORS, ORDINARY AND EXTRAORDINARY, FOR THE YEAR 1816.

His Grace the DUKE of BUCCLEUCH and QUEENSBERRY—President

Most Noble the MARQUIS of LOTHIAN.
Right Hon. the EARL of WEMYSS and MARCH.
Right Hon. EARL GOWER.
Right Hon. ARCHIBALD LORD DOUGLAS.

} Vice Presidents,

GILBERT INNES, Esq. of Stow—Treasurer.

R. MACDONALD, Esq. of Staffa—Secretary.

ROBERT WILSON, Esq. Accountant in Edinburgh—Auditor of Accounts.

LEWIS GORDON Esq.—Depute Secretary and Collector.

Mr CHARLES GORDON—Assistant ditto and Recorder.

Reverend Dr GEORGE BAIRD, Principal of the University of Edinburgh—Chaplain.

Mr JAMES MACKAY—Jeweller and Medallist.

ORDINARY DIRECTORS, ACCORDING TO SENIORITY.

John Dickson, Esq. of Kilbucco and Culter.
John Anstruther, Esq. of Ardet, Sheriff of Fifeshire.
James Fergusson, Esq. of Crosshill.
Alexander Young, Esq. of Harburn.
John Gordon, Esq. W. S.
Norman Hill, Esq. of Brownhills.
John Borthwick, Esq. younger of Crookston.
William Boswell, Esq. Sheriff of Berwickshire.
Henry Mackenzie, Esq. Comptroller of Taxes.

Vans Hawthorn, Esq. of Garthland.
 Sir Patrick Walker, Advocate.
 William Molle, Esq. of Mains.
 K. Williamson Burnet, Esq. of Monboddo.
 William Macdonald, Esq. of St Martins.
 Sir Alexander Gordon of Culvennan.
 C. G. S. Monteith, Esq. of Closeburn.
 James Traill, Esq. of Hobbister, Sheriff of Caithness.
 Rear-Admiral Fraser.
 H. H. Drummond, Esq. younger of Blair-Drummond.
 H. Macdonald Buchanan, Esq. of Ross.
 Henry Jardine, Esq. Dep. King's Remembrancer in Exchequer.
 Thomas Mackenzie, Esq. younger of Applecross.
 John Tait, Esq. W. S.
 Walter Scott, Esq. Abbotsford.
 William Horne, Esq. Sheriff of Haddingtonshire,
 William Kerr, Esq. Secretary General Post-Office.
 William Campbell, Esq. W. S.
 Michael Linning, Esq. of Colzium.
 John Graham Dalyell, Esq. Advocate,
 Daniel Vere, Esq. of Stonebyres.

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His Grace the Duke of Argyll.
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 Right Hon. Lord Viscount Melville.
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 Alexander Keith, Esq. of Revelstone.

No. III.

UNTO THE RIGHT HONOURABLE

*The LORDS COMMISSIONERS of His MAJESTY'S
TREASURY,*

**The MEMORIAL of THE HIGHLAND SOCIETY OF SCOTLAND,
constituted by Royal Charter.**

THE HIGHLAND SOCIETY OF SCOTLAND, impelled by the most powerful motives for the welfare of those countries which are, by its institution, more peculiarly placed under its care, begs leave humbly to represent to His Majesty's Ministers, that the laws now in force for regulating the distillation of spirits, and laying the duties thereon in that part of Scotland, which, in the Distillery Law, is called the 'Highland District,' require a thorough revision and many alterations, in as much as the operation of these laws, instead of permitting the manufacture of spirits for the use of the people in a legal way, has been, in most places, found altogether to prohibit it;—instead of raising a considerable revenue for the public service, which the inhabitants are very willing to pay, has only multiplied Excise Officers, and increased the public expenditure;—instead of affording a fair and honest mode of consuming the agricultural produce of the country, leaves it unsaleable in the hands of the farmer, unless he becomes the abettor of smugglers, a partner in their risks, and a sharer in their precarious and unlawful profits;—instead of protecting the fair dealer in the enjoyment of his trade, exposes him to be undersold by unlicensed illegal competitors;—and, lastly, because the operation of these laws has most manifestly seduced the mass of the people from the steady gains of honest industry, to the hazardous and most pernicious pursuits of smugglers, (and this to the ruin of their circumstances, by seizures, prosecutions and fines), to the injury of their health and natural vigour, by nightly watchings, continual alarms, and by drunkenness, and to the most irreparable loss that can befall a free people, the subversion of all honest principles, by a constant and often successful practice of frauds, evasions, falsehoods, and even perjuries.

These are not exaggerated statements, and the proofs of them are not difficult. The records of the Board of Excise will show,

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in how very few places within the Highland District distillers are legally established ; but that the number of illegal stills is very great, and has been increasing for several years, though the number of seizures and prosecutions has increased in an equal degree ; and these records will prove, that the revenue drawn from legal distillers is little more than sufficient to defray the expense of an increased number of Excisemen, who, with all the rigour of the law, are inadequate to the prevention of illegal distillation.

The Officers of that Board can explain the nature and the power of that temptation to illegal distillation which arises in most parts of the Highland District, from the impossibility of consuming the barley or bear crops in any other profitable way, and of procuring spirits for ordinary use in a legal manner, and which is universally known to arise, throughout the Highland District, from the decided preference given over all Scotland to Highland Whisky distilled by the Highlanders, according to their own ancient practice ; and hence the price of these spirits is greatly enhanced, and a sale is insured to it when smuggled into the Lowlands, to the great injury of the Revenue in that district ; while, on the other hand, from every information the Society has been able to collect, the Entered Distiller in the Highlands must be a loser by his trade, if he fairly and honestly complies with the regulations of the law of that district as it now stands.

Lastly, the Officer of Excise can best illustrate the sad depravity of morals which has been introduced by these causes.

The Highland Society has been drawn to the consideration of evils, which, in every point of view, are so vast in extent, and so big with danger to the best interests of the country, not only from the personal knowledge of a great proportion of its members, but also from representations from many parts of the country, and particularly by a Memorial from a meeting of Gentlemen and Proprietors of most of the Northern and Highland counties, who assembled at Edinburgh, and deliberated on that subject last year (1807). From these various sources of information, the Society presumes to suggest some things which may be useful in administering redress to the grievances of the country.

1st, That in order to suit the convenience of divisions of the country of greater and less extent or fruitfulness in corn, as well as the various capitals of distillers, it may be permitted to employ stills of not less than *twenty-five*, nor more than *forty-eight* gallons capacity, paying the present license duty per gallon.

2d, That under one license, 100 gallons of spirits may be worked off for each gallon of the content of the still ; and that no more than two such licenses shall be given to the same distiller in one year.

3d, That upon paying an additional duty of 7s. per gallon, it may be allowed to export with permit, into the Lowland District, 25 gallons of spirits for each gallon of the still's content.

4th, That if this privilege of export be given to the Highland distiller, the spirits made in the Highlands shall be subject to a duty of 6d. per gallon, in order to preserve a right of survey to the Officers of Excise.

5th, That the duties on worts and wash, and all the regulations respecting them, may be repealed; and, on the other hand, that no distillation be permitted in the Highland District from any other material but malt made from barley or bear, except when the Board of Excise (by virtue of special powers to be conferred on it for that effect) shall, in bad seasons, and in particular places, think fit to authorize distillation from unmalted barley or bear, the distiller always paying at least two thirds of the malt-tax for such unmalted grain.

6th, That the boundary of the Highland District may be reconsidered, and a new one adopted, upon the principle of including all places which are in the same, or nearly the same local circumstances. By the present line, the districts of Kintyre, and Cowal in Argyleshire, and the Island of Arran in the county of Bute, are thrown out of the Highland District, although these extensive countries require the same provisions in favour of their distillers as the rest of the Highlands. And it is believed that there are several tracts of country on the north-east coast of Scotland in the same situation.

In a matter so complicated, the Highland Society will not venture to be more specific in their suggestions: But the Society states, with confidence, that if the Highland Distillery was regulated so as to afford a market for the produce of the country, and a supply of wholesome spirits for the use of the people, at even a high price, the smuggler would soon be regarded as a common and public enemy, and that pernicious practice of illegal distillation would be at an end. As it is the bounden duty, so, it is the anxious desire of the Society to contribute every assistance in its power to promote such measures as the wisdom of His Majesty's Government may devise for redressing this most serious grievance, which it again earnestly recommends to the consideration of the Administration.

By order of the Society,

DON. MACLACHLAN, Secretary,

*HIGHLAND SOCIETY HALL,
Edinburgh, 4th March, 1808.*

**REPORT of the COMMITTEE of the HIGHLAND
SOCIETY of SCOTLAND ;**

*To which the State of the Distillery Laws, more especially as affecting
the Highlands of Scotland, was referred for consideration,
by the General Meeting of the Society, held
on 9th January 1816.*

YOUR Committee, in considering the subject of Distillation, are not swayed by any partial views in favour of any particular district of the country, but wish to take up the subject upon principles of general expediency and policy, as it affects the country at large, and the revenue. With these views, they beg leave humbly to report,

I. That illicit distillation prevails to a great extent in the Highland districts of the country ; and that of late years, it has been gradually extending its baneful influence into the Lowlands, and has found its way so far even as the border counties of Scotland. That this practice, and the traffic to which it gives rise, are gradually changing the character of the people, and undermining their morals ; converting those engaged in it from being a sober, a moral, and well-disposed people, obedient to the laws, and useful members of the state, into a people habitually living in breach of the law ; many of them outlaws, continually practising fraud, deceit, and violence ; holding in contempt the sanctity of an oath, living in fear of their neighbours becoming informers, and therefore obliged to corrupt them by bribes, or terrify them by threats, into silence ; and withdrawing themselves from the more sober pursuits of regular industry, and devoting themselves to this most precarious means of livelihood.

II. That this trade prevails greatly to the loss of the revenue, as a great expense is incurred in keeping up an extensive establishment of officers, which must, from the nature of the country, be quite ineffectual in preventing illicit distillation, even although aided by the cordial and active co-operation of the country gentlemen and tenants ; and as no duty is paid, the loss to government cannot be estimated at less than 300,000*l.* annually. The illicit trader, indeed, has not only succeeded in gradually driving the legal distiller out of the market of the Highlands, but is also interfering in the market of the Lowlands, in consequence of producing a more

palatable beverage, and being able to sell it at a lower rate than he could afford to do if he paid duty.

III. That all the attempts which have hitherto been made to repress this trade have proved unsuccessful ; and the Committee are decidedly of opinion, that the only effectual way of preventing the continuance of illicit distillation, is by such a modification of the law, as will permit and encourage legal stills in the Highland district ; when it will become the interest, as well as the duty of the proprietors and their tenants, to dispose of their farm produce only to the regular dealer, and to enforce the laws against illicit distillation ; while a supply of palatable spirits will be obtained for the consumption of the country, from which government will draw a corresponding revenue.

IV. That for the purpose of encouraging legal distillation, your Committee offer the following suggestions :

1. That there should be a free intercourse for spirits, between all parts of Scotland, for home consumption ; and as the correlative of this proposition, that the same rate of duty should be paid over the whole country, without distinction of Highland or Lowland. That no preference is wished in favour of one district over the other ; but, on the contrary, that such regulations should be introduced, as will put the one on a footing of fair equality with the other.

2. That in order to adapt the trade to the limited extent of capital in the Highlands, and the circumscribed limits of the market, law should authorize the licensing of spirit stills of the size of 50 or 60 gallons, permitting, however, a still of any larger capacity to be used ; the consequences of which would be, that such a number of legal stills would be entered in proportion to the capital and demand for the manufacture, as would gradually drive the illicit trader out of the market.

3. That the inferiority of the grain of the Highlands, or the mode of manufacturing it, enables the Highland distiller only to produce 15 gallons of spirit instead of 18, from 100 gallons of wash ; and, to make him pay duty for 18, tempts him to purchase the deficient quantity from the illicit distiller ; which, at the present rate of price and duty, is more advantageous to him, than paying duty for the deficiency. That, therefore, in order to remove entirely every encouragement for the illicit trade, the quantity of spirit to be produced, should be reduced to 15 gallons.

4. But as this would probably lead to a system of restriction to prevent imported grain from obtaining this privilege, and as it seems undeniable that every system of restriction is injudicious,

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and founded on false principles in political economy, your Committee would rather recommend, that the whole duty should be charged on the quantity of spirit according to its strength, as ascertained by its weight, which is the principle recommended by this Society, in the new system of weights and measures—that all measures of capacity should be ascertained by weight. This would remove at once the necessity of producing a certain quantity of spirit from a given quantity of wash, as the duty would only be charged on what was actually produced, and would leave each distiller to use what grain he thought proper, and get what produce he could from it.

V. The effect of these, or similar regulations, your Committee are of opinion, would gradually operate in putting down illicit distillation. It cannot be expected that, in so rooted and widespread an evil, the success would be immediate, or that legal stills would at once be established all over the country. Many, however, would immediately be entered. The frequent changes in the law have made many afraid of embarking their little capital in this trade; but as they acquire confidence in its stability, both the number and the size of the stills would increase. Your Committee are decidedly of opinion, that, from the physical circumstances of the country, it would not be possible to effect an universal change, unless stills as low as 50 or 60 gallons are licensed. In some parts of the Highlands, (those bordering on the Lowlands and sea coast for example), there might be both capital and a market sufficient to establish and support larger stills. But in the interior and remote parts of the country, where the extent of arable land is extremely small, and these portions lie insulated from each other, surrounded by almost inaccessible mountains, cutting off all easy access with the low country, or with each other, the supply of grain would not admit of the erection of large sized stills: Hence, if large stills only were legal, the illicit trade would continue, because only small stills could be generally used there, and the illicit trader would continue to be encouraged as affording the only market for barley, without which it would be impossible for the tenants to pay their rents. The consequence would be, that, paying no duty, he would be able to undersell the legal distiller, and thus again drive him out of the market.

As no duty can at present be drawn from the Highland district, whatever surplus duty is afforded by a still after paying for the expense of superintendence, would be a gain to the revenue. The proprietor and his tenants finding a market with the licensed distiller for their grain, would deal no longer with the illicit distiller;

it would become their interest to protect the trade of the person who gives them this market; and it is the interest of this trader to prevent the interference of any other with his trade. He, therefore, becomes an informer against the illicit trader; and he and the magistracy of the country would alike assist the officers of the Excise in protecting the revenue, and also act as a most effectual compulsitor upon them to the diligent and incorrupt discharge of this duty, which sometimes is found to interfere with their interest. In proportion as the illicit trader is driven out of the market, either new stills will be entered, or the former ones enlarged to meet the demand, till gradually the whole country is supplied from legal stills; the illicit trade interfering no longer with the trade of the entered distiller either in the Highlands or the Lowlands, and Government deriving full advantage from this source of revenue.

VI. Your Committee is of opinion, that a short Memorial, founded on the above principles, should be drawn up and forwarded to the Lords of the Treasury; and, that it should be recommended to the counties who feel interested in this matter, also to present memorials to the Treasury on this important subject.

13th February, 1816.

J. H. FORBES, Convener.

HIGHLAND SOCIETY CHAMBERS,
Edinburgh, 16th Feb. 1816.

At a meeting of the Directors of the Highland Society of Scotland, held here this day, the EARL OF WEMYSS in the Chair, the preceding Report was taken under consideration and approved of.—Resolved, That a Memorial founded upon the principles of the Report shall be prepared, and transmitted, in name of the Society, to the Lords of His Majesty's Treasury:—That the Report shall be printed, and copies thereof transmitted by the Secretary to the Conveners of the several Counties of Scotland, and circulated in such other manner as the Committee shall judge proper.

CHARTERIS, WEMYSS & MARCH, V. P.

END OF VOLUME FOURTH.



